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CHEMICAL AGE

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OVER THE BORDER

WARTIME developments in Scotland when factories for defence purposes were set up meant that at the end of the war a number of establishments were available for industrial purposes.

Under the Distribution of Industry Act 1945, main Scottish industrial areas—Clyde Valley, City of Dundee and Inverness—received special assistance for industrial development, and erection of some 10 million square feet of new factory space was undertaken by the Government assisted by the Board of Trade, Scottish Industrial Estates Ltd. (BoT's agents in Scotland) and the Scottish Council (Development and Industry), an independent organisation which has indicated to home and overseas manufacturers the prospects for industrial development in Scotland.

This issue of CHEMICAL AGE contains a special section devoted to the chemical industry and allied trades in Scotland. A glance at the tabulated section on p. 814 will quickly indicate the many new plants which have come into operation in the last year or so, and the new plants which are either being erected or are in the planning stage. Another section is devoted to the Grangemouth area, as it is this area of Scotland which has seen such spectacular developments since the second world war ended. At Grangemouth, on the Firth of Forth, has been established the great oil and petrochemical industrial investment costing, with works completed or in progress and near future plans, some £50 million, which is expected to provide employment for more than 2,000 people. From the small refinery set up by Scottish Oils Ltd., a member of the British Petroleum Co. Ltd., has grown the large BP Refinery (Grangemouth) Ltd. Details of the present capacity of this refinery and the plans for the future are discussed on p. 820. From crude oil are produced motor spirit; propane and butane; white spirits; kerosene, gas oil, diesel oil and fuel oil for industrial use. At the same time sulphur is produced and petroleum distillates which form the feedstock of British Hydrocarbon Chemicals Ltd. This chemical plant by cracking the distillate in turn supplies ethylene and propylene to its part-owned subsidiary companies, Forth Chemicals and Grange Chemicals, and for the US-owned Gemec Ltd.

BHC, already in the synthetic rubber field with butadiene, are now to enter the plastics field with low-pressure polythene. Another new plant to be set up by the company is a synthetic phenol plant which will provide acetone as well. When the present total £25 million investment is completed, some 1,200 people will be employed on the 160-acre site.

Production of drugs and pharmaceuticals has been an established industry in Scotland for many years, particularly in the Edinburgh area. The industry has grown significantly, however, in the last 10 to 15 years. Today some 10 enterprises produce drugs and pharmaceuticals and allied products and employ about 1,500 to 2,000 people, while other pharmaceutical concerns have large packaging and distributing centres situated in the main around Edinburgh and Glasgow areas.

It was the need for antimalarial drugs, in particular mepacrine, in 1942 which caused ICI's Grangemouth dyestuffs works to manufacture mepacrine and sulphonamides. Today antimalarials and sulphonamides are still manufactured at this ICI works, and indeed, the ranges of both these drugs have been

considerably extended by new ones, and other new drugs have been developed. Indeed, the main part of ICI's production of drugs and pharmaceuticals is undertaken in plants at Grangemouth and Linlithgow.

Growing demand for alginates has resulted in a profitable revival of the old Scottish kelping industry. Indeed, the alginate industry founded in 1934 has in the last decade proved a notable economic development by providing employment in distant areas of Scotland, notably the Orkneys and Hebrides, and by virtue of its export trade a valuable contribution to British export trade.

For many years ICI's Nobel division, with its headquarters in Glasgow and its main plant at Ardeer, has made explosives, and alongside these other basic chemicals such as nitric acid and sulphuric acid for its own and outside use. Today the Ardeer plant is the largest commercial explosives factory in the British Commonwealth; and its research organisation is one of the largest in British industry. Further information on this ICI division's work can be found in p. 823 of this issue and in the issue of 5 April, p. 631. In the last decade export trade by Nobel division has so increased that today one-third of its total production is exported.

Manufacture of dyes and dyestuffs has a long factory history in Scotland, especially in the Glasgow area. It was immediately after the first world war that the industry developed on a large scale. Today many of dyestuffs manufactured at Grangemouth are world famous. Indeed, the ICI works pioneered the Duranols for dyeing acetate rayon. Today these dyestuffs have gained new importance as they are widely used for nylon and Terylene.

There are quite a few companies making fertilisers in Scotland, but the greater part of Scottish fertiliser production is in the hands of Scottish Agricultural Industries, which incorporates five of the leading agricultural companies in Scotland, and Fisons Ltd. SAI's new fertiliser works at Leith, which was officially opened on 17 March last, was described in detail in the 22 March issue of CHEMICAL AGE.

Several rubber companies operate in Scotland, and it seems likely that with the growth of the petrochemicals industry at Grangemouth, more factories to process synthetic rubbers and also plastics will come into operation.

Of the new industries allied to the chemical and pharmaceutical industries there is the electronics industry. Electronic work is being undertaken in Scottish electrical factories. In fact, two recently established concerns now employ several thousand persons and have helped in overcoming employment problems. The industrial instruments produced, besides increasing productivity in the Scottish chemical industry and other industries, also make a valuable contribution to British export economy.

Now with the rapid developments in atomic power, Scottish companies are also to the forefront here. From fundamental research have been developed highly specialised techniques which have been applied to the Zeta thermonuclear apparatus. It was Telcon-Magnetic Cores Ltd. whose cores were used at Harwell, and who also provided handling equipment for positioning these. More than a score of other companies in Scotland are now producing electronic components or parts, or research and design units and special instruments for nuclear work.

What does the future hold for Scotland? Post-war expansion as we have seen, has been prolific, but this expansion seems to have been checked last year for the first time since 1957. There is now a wide spread of industry in the country, but concern is being expressed about unemployment 'black spots'. The basic industries on which Scotland is mainly dependent are still considered to be in a fundamentally strong position. However, Scotland has also strengthened its position by the development of secondary industry, particularly through US investment (70 per cent of all that has come to the UK). In this secondary industry development must be included the chemical, pharmaceutical and allied industries.

Many of the newer industries are making notable contributions to British export trade. At the same time Scotland is also an exporter of managerial, scientific and technical personnel. Some 25 per cent of UK technologists are produced by Scottish colleges and it is believed that over half of them leave Scotland. This export of talent is undoubtedly a danger to Scottish industrial development, particularly in the chemical and electronics fields, for a skilled worker usually provides employment for several unskilled workers. It is to be hoped that with the further growth in Scotland's secondary industrial development this talent may choose to stay in the country.

HIGHER POTENCY ANALGESICS

SUBSTITUTION of chemical groups in analgesic compounds can either increase or decrease potency or toxicity. (See article by Peter Cooper, CHEMICAL AGE, last week.) According to research workers at Sterling-Winthrop Research Institute, replacement of the N-methyl group found in many analgesics with an aralkyl group will increase potency in analgesics. This substitution has been tried with Demerol and has resulted in the analgesic effects of this compound being increased. The aralkyl group which has proved most effective, these workers report, is the cinnamyl group.

Speaking about their discovery at the 133rd ACS national meeting, the Sterling-Winthrop researchers headed by Dr. W. Elpern, said that after observing the striking effect of cinnamyl substitution on Demorol, they also investigated the effect of a similar change in several of the most widely studied groups of strong analgesics. Replacement of the N-methyl group of amidone by cinnamyl produces a compound too toxic even to evaluate. On the other hand, the cinnamyl analogue of thiambutene has been found to have little or no analgesic activity. Substitution in the prodine series, however, gives worthwhile results. This finding leads Elpern to state that the cinnamyl group is most effective in materials which have nitrogen in a piperidine ring as in the prodine compounds.

This work points the way to the possibility of preparing analogues of certain analgesics having increased potency without higher toxicity or undesirable side-effects. It is also believed that this work can assist in studying how analgesics act.

MORE US LP POLYTHENE

COMMERCIAL production of Ziegler-type low-pressure polythene has now begun by Union Carbide. Capacity of the plant is 30 million lb. a year. Thus the first low-pressure process plants on which construction started nearly two years ago are nearly all in operation now (see CHEMICAL AGE, 29 March, p. 584.) The remaining plant scheduled to be operating this year is that of Koppers, at New Jersey.

Views expressed in the US show that LP polythene producers expect this plastics material to take 10 to 15 per cent of the present high-pressure polythene market, the output of which last year totalled 694 million lb., 10 per cent more than was expected. Polythene output for January in the US is put at 69.5 million lb., a 33 per cent increase over the 1957 figure. The LP polythene output included in this total was small (*Chem. and Engng. News*, 1959 **36** No. 14).

Low-pressure polythene producers have evidently been thinking in terms of sales of the order of one-third to one-half of capacity. However, the more realistic figure is a probable 50 to 60 million lb. (some 7 per cent of a total of 800 to 850 lb. of polythene for 1958). Markets in late 1958 and 1959 are expected to expand considerably as more moulding equipment is installed and end uses grow.

CHEMICAL PRODUCING CENTRES IN SCOTLAND

A Special Chemical Age Survey of the Scottish Chemical Industry

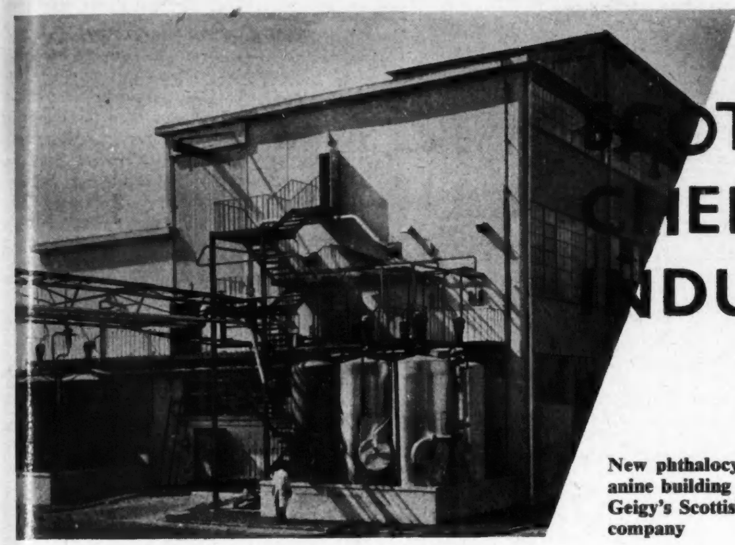
KEY TO PRODUCTS

- ■ Heavy chemicals
- □ Agricultural chemicals
- ○ Pharmaceuticals, fine chemicals
- × Coal tar distillation products
- ▲ Explosives
- △ Dyestuffs
- ⊠ Petrochemicals
- ⊗ Plastics

COMPANY	PLANT	MAIN PRODUCTS	NEW PROJECTS
Alginate Industries Ltd., Bedford St., London WC2	Barcaldine-by-Connel and Girvan	Alginates—the salts and derivatives of alginic acid	—
Anderson, James & Co. (Colours) Ltd. (See under Geigy Co. Ltd., The)			
G. & J. Boyd Ltd.	Collinslee Chemical Wks., Paisley	Dyeing and finishing materials for the textile trade	—
British Bitumen Emulsions Ltd., Dundee Rd., Trading Estate, Slough, Bucks	20 Maukinfauld Rd., Glasgow E2	Concrete additives, anti-corrosive paints, fluorine compounds/adhesives/seals, adhesives for insulation material and seals, membrane D.T.C.s, roof coatings	—
British Chrome & Chemicals Ltd., 6 Arlington St., London SW1	Shawfield Wks., Rutherglen, Nr. Glasgow	Sodium dichromate, potassium dichromate, sodium chromate, potassium chromate, ammonium dichromate, chromic acid, chromium oxide, chrometan	Substantial reconstruction in progress; estimated completion, autumn 1959
British Dyewood Co. Ltd., The, 19 St. Vincent Pl., Glasgow C1	Carntyne Dyewood Mills, Parkhead, Glasgow	Dyewood and tanning extracts, tannic acid, gallic acid, pyrogallic acid, cascara sagrada extract BP, quinine and salts, ephedrine and salts, a variety of alkaloids	—
British Hydrocarbon Chemicals Ltd.	Grangemouth	Ethylene, propylene, ethyl alcohol, isopropyl alcohol, tetrapropylene, butadiene	Phillips' LP-polythene plant under construction. Synthetic phenol plant planned using DCL cumene conversion process, which also produces acetone. Cumene to be made from benzene and propylene. The plants will cost over £8 million; both due on stream 1959
British Oxygen Co. Ltd., Bridgewater House, Cleveland Row, London SW1	460 Helen St., Govan, Glasgow; Queen Elizabeth Ave., Hillington, Glasgow; Porehill Wks., Glasgow S2	Industrial gases	—
British Oxygen Gases Ltd., Bridgewater House, Cleveland Row, London SW1	Polmadie St., Glasgow	Liquid oxygen	Work started in March on this new site. Oxygen compressing capacity 3 million cu. ft. per week. Estimated completion date, March 1959
British Petroleum Refinery (Grangemouth) Ltd.	Grangemouth	Refined oil, sulphur, chemical intermediates, etc.	Planned £8 million extensions include crude oil distillation plant, two new copper chloride treatment plants and Petrico plant for treating oil gases for removal of acids, etc. New H_2S and mercaptan removal. Girbotol plant installed by Power-Gas
Bryant & May Ltd., Fairfield Wks., Bow, London E3	Empire Wks., Shuna St., Maryhill, Glasgow	Matches	New works being erected at Maryhill. To cost £250,000.
Clydesdale Chemical Co. Ltd., The, 105/147 Millerston St., Glasgow E1. (Sales: 142 Queen St., Glasgow C1)	Millerston St., Glasgow E1	Actibon decolourising carbons	Additional plant will be laid down as necessary to meet any further increase in demand
Colvilles Ltd.	195 West George St., Glasgow C2	Sulphate of ammonia	—
Cooper, McDougall & Robertson Ltd., Berkhamsted, Berks	Kelvindale Wks., Lochburn Rd., Glasgow NW	Household insecticides, sheep and cattle dips, fly sprays, disinfectants	—
Dixons IronWorks Ltd.	525 Crown St., Glasgow C5	Tar, sulphate of ammonia, refined motor spirit (benzole) and naphthalene	—
Edinburgh Hygienic Co. Ltd.	3 Canon Lane, Canonmills, Edinburgh 3	Insecticides	—

COMPANY	PLANT	MAIN PRODUCTS	NEW PROJECTS
isons Ltd., 95 Wigmore St., London W1	Bo'ness	Fertilisers	10,000-ton fertiliser store opened at Aberdeen, December 1957. Aerial spraying service started at Perth aerodrome, spring 1958
Forth Chemicals Ltd.,	Grangemouth	Styrene monomer, ethyl benzene, diethyl benzene, polyethyl-benzenes, toluene	New liquid nitrogen plant and pipeline for blanketing styrene
Garroway, R. & J. Ltd.	Netherfield Wks., 694 Duke St., Glasgow E1	Bulk fertilisers and acids	—
Geigy Co. Ltd., The, Rhodes, Middleton, Manchester	Paisley (James Anderson & Co. (Colours), Ltd.	Organic pigments, including toluidine reds, arylamide and benzidine yellows, basic dye toners, pigments of Naphthol AS series	Phthalocyanines plant recently completed; other manufacturing units being constructed
Gemec Ltd., Mount St., London W1. (Union Carbide Ltd.)	Grangemouth	Polythene	£4½ million polythene plant with 12,000-ton capacity. Plant started up in February. Nitrogen producing plant, recently installed
Glaxo Laboratories Ltd., Greenford, Middx.	Montrose	Corticosteroids and liver extracts including hydrocortisone alcohol and acetate, prednisone, prednisolone; liver extracts	—
Grange Chemicals Ltd.	Grangemouth	Detergent alkylate. Sales agents for BHC tetrapropylene and Oronite isophthalic	LP polythene plant to produce 11,000 tons a year is in planning stage
Haldane, Robert & Co. Ltd.	Underwood Chemical Wks., Murray St., Paisley	Parachlorometaxylenol, 2:4 dichlorometaxylenol, chlorocresol, Liquor Chloroxylenolis BP, antiseptic fluids, disinfectant fluids, chlorinated xylenols, chlorinated high boiling tar acids, benzyl cresol	Planned are laboratory extensions and buildings to house new plant now in pilot plant scale production
Harley, Thomas Ltd.	55 S. Methven St., Perth	3 (α-phenyl-β-acetylethyl)-4-hydroxycoumarin, Rodine phosphorus rodenticides, Rodine Warfarin rodenticides	—
Imperial Chemical Industries Ltd. Dyestuffs division, Blackley, Manchester	Grangemouth	Phthalic anhydride, vat dyestuffs, foaming agents, pigments, pharmaceuticals, textile chemicals, tanning agents	Under development: a new antiseptic and other drugs. Expected to reach production stage soon
Nobel division, Glasgow	Ardeer Factory, Stevenston, Ayrs	Blasting explosives, detonators, safety fuses, industrial nitrocellulose, acids, nitrates, Cellofas, silicones	Second Biazzi plant now operating at designed output. Last batch mill to be replaced by new plant, continuous in operation. Construction started on large isopropyl nitrate plant. Extensions to silicones plant now in full production. New plant for concentrating nitric acid by magnesium nitrate process in operation at designed output. New 'special feature' nitric acid plant in design stage (expenditure authorised). Industrial nitrocellulose dehydration plant commissioned winter 1957. Trials carried out at No. 1 mechanised nitro-glycerine unit, Misk Works
Drungans	Dumfries	Industrial nitrocellulose, pentaerythritol, Cellophas	Extensions to Cellofas plant completed. Suggested that ICI may reopen Ardil plant for production of plastics in 1960–61 on installation of new plant
Lind, William, & Co. Ltd., Elderlie, Renfrewshire	Ullapool, N. Scotland	Magnesium limestone	£80,000 plant to be erected at new quarry to produce 80,000–100,000 tons a year pulverised limestone
Lythgoe, Adam	Heathfield Airport, Ayr.	Specialised fertilisers	New plant for hyperphosphate (29% P_2O_5) and hyperkali 22% P_2O_5, 12% K_2O)
Macfarlan, J. F. & Co. Ltd., 109 Abbeyhill, Edinburgh 8	Abbeyhill & Northfield, Edinburgh	Alkaloids of opium, ether, chloroform	Production increased. Two new anaesthetics introduced: Neothyl (methyl-n-propyl ether) and Lignocaine
Northern Agricultural & Lime Co. Ltd., Aberdeen	Blaikie's Quay, Aberdeen	Granulated compound fertilisers	—
	Limehillock Quarry, Grange, Banffs	Ground limestone for agricultural purposes	—

COMPANY	PLANT	MAIN PRODUCTS	NEW PROJECTS
Organon Laboratories Ltd., Brettenham House, London WC2	Newhouse-by-Motherwell, Lanarks	Complete range of steroid and trophic hormones.	—
Parozone Co. Ltd., The	203 Carntyne Rd., Glasgow E1	Parozone and chloride of manganese	—
Paterson, John & Co. Ltd.	Clensel Wks., Orr St., Glasgow SE	Insecticidal sprays, 'Clensel' products	—
Moore, Quintin & Sons	Rumford Chemical Wks., W. Bridgend, Dumbarton	Disinfectants, liquid soap, soft soaps, soluble oils	Renewal & modernisation of plant
Roche Products Ltd., Welwyn Garden City, Herts	Dalry, Ayrs	High potency acetate and palmitate concentrates of vitamin A	New synthetic vitamin A plant on stream last year; plant now working to full capacity (40 million million IU a year)
Scottish Agricultural Industries Ltd., Palmerston Pl., Edinburgh	Leith	Concentrated complete fertilisers, monammonium phosphate	£3 million plant opened 17 March includes 175 tons a day sulphuric acid plant, Prayon phosphoric acid plant, 66 tons P_2O_5 a day
	Sandilands Chemical Wks., Aberdeen	Sulphuric acid, superphosphate, and granular compounds, based on superphosphate	—
	Dyce, Nr. Aberdeen; Port Dundas, Glasgow; Ayr Fertiliser Wks., Newton-on-Ayr	Fertilisers	—
Scottish Diatomite Ltd.	Staffin, Portree, Isle of Skye	Diatomite	New artificial drying plant is expected to treble output at the Skye factory
Scottish Gas Board, 27 Drumsheugh Gdns., Edinburgh 3	Provan Chemical Wks., 990 Royston Rd., Glasgow	Refined tar, pitch, coal tar fuels, timber preservation creosote, hydrogenation creosote, fluxing oils, motor benzole, short-range toluole, short-range xylole, 91/60 solvent naphtha, 91/91 high-flash naphtha, pyridine bases, phenol, o-cresol, m-p-cresol, low-boiling xylenols, high-boiling xylenols, high-boiling tar acids, white emulsion and pink emulsion	Lurgi high-pressure gasification plant at Westfield, Nr. Loch Leven, Fife
	Dawsholm Chemical Wks., Glasgow NW	Tar distillation plant (pot stills); ammoniacal liquor	
	Dalmarnock Chem. Wks., Bridgeton, Glasgow	Tar distillation plant (Dalton continuous)	
	Tradeston Chemical Wks., Glasgow C5	Ammoniacal liquor only	
	Gas Wks., Hawick	Tar distillation plant	
Scottish Tar Distillers Ltd., Falkirk	Falkirk, Glasgow, Paisley and Irvine	Road binders, pitch, creosote oil, low sulphur and other coal tar fuels, motor benzole, naphthas, toluol and xylol, phenol and other intermediates, naphthalene	Under construction are continuous tar distillation plant for commercially pure phenol, xylenol, orthocresol and meta-para cresol and new plants for extraction and refining of coal tar acids and naphthalene
Sheriffs, J. A. & Co.	Royston Wks., W. Shore Rd., Edinburgh 5	Sulphur compounds (mostly for foodstuffs)	—
Smith, T. & H. Ltd.	Blandfield Chemical Wks., Edinburgh 11	Opium and other alkaloids; other pharmaceuticals including BP and BPC galenicals, synthetic alkaloids, atropine, homatropine and hyoscyamine	Homatropinium phenacyl chloride recently made available as Trophenium
Sulfurphosphate Manufacturing Co. Ltd.	Garrion Mills, Wishaw	Fertilisers	—



SCOTLAND'S CHEMICAL INDUSTRY

New phthalocyanine building of Geigy's Scottish company

SCOTLAND can boast a flourishing and diverse chemical industry, ranging from heavy chemicals to dyestuffs and pharmaceuticals. Represented north of the border are more than 100 chemical firms, including many companies with their headquarters in Scotland, and others that have established branch factories there. Apart from the vast chemical complex at Grangemouth (described in pages 820 to 823) the largest company with a stake in the Scottish chemical industry is ICI Ltd.

Its range includes dyestuffs, pharmaceuticals, explosives, silicones and through its associated company, Scottish Agricultural Industries Ltd., it has an interest in fertiliser production in Scotland. ICI dyestuffs and pharmaceutical operations are described in our Grangemouth feature.

The heart of the UK industrial explosives industry is in the west of Scotland. Ardeer factory in Ayrshire—the principal production centre of *ICI Nobel division* is the largest of its kind in the northern hemisphere. From small beginnings 85 years ago, Ardeer was expanded until today it occupies some 2,000 acres and produces large quantities of many different kinds of commercial explosives, detonators and fuses for coal mining, metal mines, quarries, civil engineering projects, demolition and for oil prospecting using the seismic method.

Parallel with the enormous growth of these specialised manufactures, the industry has been diversified and important products now made at Ardeer include industrial nitrocellulose, the 'Cellofas' range of cellulose ethers and esters, sulphuric acid, nitric acid, potassium and ammonium nitrates and most recently silicones, in a plant that was greatly enlarged this year. At the division's Dumfries factory, pentaerythritol, special grades of 'Cellofas' and industrial nitrocellulose are made.

1957 was a year of significant advance in the techniques of explosives manufacture. These advances were made possible by extensive instrumentation and the application of electronics and precision engineering which gave yet greater safety to operators and increased efficiency to the process.

In August, for the first time in the world, a nitroglycerine plant (of the Biazzi type) was operated completely by remote control, after an induction period during which processmen became familiar with the instrument panel and controls in the process building. These instruments and controls are now housed in a reinforced concrete shelter, shielded and removed from the actual nitrating room. TV cameras scan the process room and relay visual information to a screen in the remote control room.

A similar installation was commissioned in March 1958, but visual observations will be by a high-grade optical system on the periscope principle when complete remote control is established later this year.

An experimental remote control unit for explosives manufacture will soon be in operation. This work has as its object the establishment of remote control manufacture, so that operators will be removed from buildings in which explosive materials are mixed and cartridged.

During 1957, machines designed by Nobel division research engineers were installed to test and grade fuseheads and further operations in electric fuse assembly are being mechanised. A mechanised unit designed by the division's research engineers and physicists for the entire manufacture of plain detonators is undergoing extensive and successful proving trials. It is expected to take over the main manufacture during the next few months.

Capacity for blackpowder manufacture was enlarged in 1957 and a substantial extension of capacity for blasting explosives manufacture is ready to be commissioned.

In Ardeer acids department, a plant for the concentration of dilute nitric acid was built during 1957 and has been commissioned. The plant is novel and employs magnesium nitrate in solution as the concentrating plant.

A new plant to make isopropyl nitrate, a valuable starting agent for jet engines and an additive which upgrades diesel fuel, is being built because the capacity of the existing unit is insufficient to meet demand.

Substantial extensions to the Ardeer silicones plant were commissioned in the early spring of this year. The plant produces the complete range of silicone fluids, resins and rubbers.

Last year a central power station was built in Ardeer to take over the work of several smaller boiler stations. During the first months of 1958 this station came into operation and provides all the steam and electricity needed by a large factory. Significant economies will result. Steam is raised at high pressure and is reduced to pressures acceptable to the factory mains by passing through turbo alternators.

At Dumfries factory a new pentaerythritol plant was fully commissioned during the first quarter of 1958 and a new 'Cellofas' plant to make special grades was effectively commissioned in 1957. This year a paraformaldehyde plant will be built.

The cost of the plants built by Nobel division in Scotland last year or now being built is about £3½ million.

A company with its headquarters in Scotland, but which does not own any chemical works there, is the *Tharsis Sulphur and Copper Co. Ltd.*, 136 West George Street, Glasgow C2. This company owns pyrites mines in the province of Huelva, Spain.

The new £3 million plant of *Scottish Agricultural Industries Ltd.*, designed to produce complete concentrated fertilisers was opened by Sir Alexander Fleck in March (see CA, 22 March, p. 539). The three major plants here are a Simon-Carves-Monsanto contact sulphuric acid plant, a Prayon phosphoric acid unit and a neutralising and compounding plant, designed by Dorr-Oliver Inc., and built by Simon-Carves.

Other SAI manufacturing units in Scotland are at Sandilands Chemical Works, Aberdeen, where sulphuric acid, superphosphate and granular compounds based on superphosphate are made. The factories at Dyce, near Aberdeen, Port Dundas, Glasgow, and Newton-on-Ayr produce superphosphate and granular compounds.

Remote control room of ICI Nobel division's nitroglycerine unit. Closed circuit TV and intercom system with microphones enable visual and aural observation to be made

Fertilisers are also produced at the Bo'ness fertiliser factory of *Fisons Ltd.*, on the Forth estuary. This fertiliser and chemical group, whose annual turnover is £45 million, claim to supply about 40 per cent of the plant nutrients used annually by UK agriculture. The Bo'ness plant supplies the company's fertiliser depots at Aberdeen (which takes up to 10,000 tons of fertilisers and was opened last December) Broxburn, Maybole, Perth, Leith and Burntisland.

The company's Scottish area sales office is at 49 North Castle Street, Edinburgh. The Fisons' technical advisory service is freely available to any Scottish farmer. Also making a contribution to Scottish agriculture are Fisons Pest Control Ltd., who established this spring an aerial contracting service operating from Perth aerodrome. Four aircraft are available for fertiliser application, weed control in corn and grassland, and control of blight on potatoes.

Granulated compound fertilisers are made by the *Northern Agricultural Lime Co. Ltd.*, at Blaikie's Quay, Aberdeen. This company are also quarry masters at Limehillock Quarry, Grange, Banffshire, where ground limestone is produced for agricultural purposes.

Scottish Tar Distillers Ltd., Lime Wharf Chemical Works, Falkirk, are one of the oldest of Scotland's chemical companies, having been founded in 1845 for the distillation of crude gas works and coke oven tars. The company treats more than 70 per cent of the crude coal tar from Scottish coke ovens and gas works, and to keep abreast with the increased output of crudes, additional and up-to-date units have been built.

Coal tar products are the basic raw materials for several of the country's major industries and as such, derivatives are probably put to a greater variety of uses than any other substances.

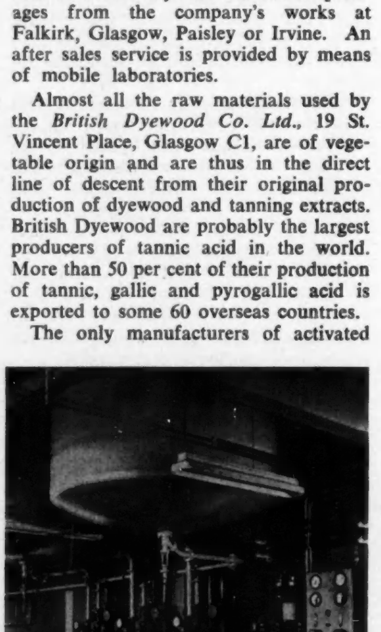
Principal products of Scottish Tar Distillers are: road binders; pitch for briquette manufacture; creosote oil; low sulphur fuels and other coal tar fuels for gas turbines and the production of special steels, etc.; motor benzole; naphthas, toluol and xylol for the paint and rubber industries; phenol and other intermediates used in the production of synthetic resins; and naphthalene for phthalic anhydride, one of the most versatile chemicals in industrial use to-day.

The development of plastics and associated industries has led to exacting demands being made on coal tar distillers for materials to very rigid specifications. In order to continue to meet these new developments, the company is erecting additional plants of the most modern design for the extraction and refining of coal tar acids and naphthalene.

Each stage of production is under the strict supervision of the laboratories, where in many cases standards of purity are enforced in excess of BSS demands. Products are made to customers' requirements and delivery made in bulk or packages from the company's works at Falkirk, Glasgow, Paisley or Irvine. An after sales service is provided by means of mobile laboratories.

Almost all the raw materials used by the *British Dyewood Co. Ltd.*, 19 St. Vincent Place, Glasgow C1, are of vegetable origin and are thus in the direct line of descent from their original production of dyewood and tanning extracts. British Dyewood are probably the largest producers of tannic acid in the world. More than 50 per cent of their production of tannic, gallic and pyrogallic acid is exported to some 60 overseas countries.

The only manufacturers of activated decolourising carbons in Scotland are the *Clydesdale Chemical Co. Ltd.*, whose factory and head office are at 105-147 Millerston Street, Glasgow E1. The sales office is at 142 Queen Street, Glasgow C1. Production has been expanding continually since the war to meet the increasing demands of home and export markets. The company intends to lay down additional plant when necessary to meet any further increased demands.



Pump manifolds in the press room of the Geigy phthalocyanine plant at Paisley

The Shawfield Works, Rutherglen, near Glasgow, are a major production unit of *British Chrome and Chemicals Ltd.* Substantial reconstruction of this plant is in progress and it is estimated that it will be completed by the autumn of 1959. The product range comprises: sodium dichromate, potassium dichromate, sodium chromate, potassium chromate, ammonium dichromate, chromic acid, chromium oxide, and chrometan.

A new post-war Scottish industry is that set up by *Alginate Industries Ltd.* Alginates, the salts and derivatives of alginic acid, are extracted from seaweeds and the industry is based on the abundant supplies available from the shores of the Hebrides and Orkneys. The old kelping industry has been revived in a new form and a valuable natural resource brought into economic use. The collection of seaweeds for alginate extraction makes an important contribution to the livelihood of hundreds of crofters. Alginate manufacture begins as a rural industry, it uses domestic materials and even the chemical factories are sited in districts where the employment they offer is welcome to the local workers.

Although the industry was founded in 1934, the commercial development of alginates is largely post-war and in the past 12 years, output and sales have increased fourfold. Every year, more industries find new uses for alginates. They are used extensively in textiles, paints, welding, rubber, pharmaceuticals, cosmetics, foods, confectionery, ice cream and leather. An important new use, now being developed is the surface treatment of paper and boards for the improvement of printability. More than half the production of Alginate Industries is exported and British alginates are now sold in 50 different countries.

Geigy have recently extended their pigment manufacturing plant in Paisley (*James Anderson and Co. (Colours) Ltd.*) This increased production is destined entirely for sale by the *Geigy Co. Ltd.* Recent extensions include, besides a spacious welfare building, new plant specially designed and built for the manufacture of phthalocyanines. Other manufacturing units are still in course of construction.

Production at Paisley, which is confined to organic pigments, includes a complete range of colours for the paint, printing ink and plastics industries, for the mass dyeing of viscose rayon and for colouring other products such as artists' colours, soap, linoleum, typewriter ribbons and carbon papers. The range includes the toluidine reds, arylamide and

benzidine yellows, basic dye toners, pigments of Naphthol AS series, and many other speciality pigments tailor-made for the industries supplied. The pigments are sold in the form of finely ground powders and specially prepared aqueous dispersions under the trade name of Irgalite. Of particular interest is the Irgalite SPV range designed for the coloration of emulsion paints.

Geigy have been making phthalocyanine blue in Switzerland for many years but have only now begun to make it in Scotland. The first three standards are Irgalite fast brilliant blue BNL, Irgalite fast brilliant blue GLS and Irgaplast brilliant blue BLP; others will be introduced to complete the range of blues in due course.

Scotland has a large pharmaceutical industry with a wide product range. The Montrose factory of *Glaxo Laboratories Ltd.* was opened in June 1951 as a unit for the manufacture of corticosteroids and liver extracts. At first cortisone production was conducted with a handful of staff on a purely experimental basis. Regular production started late in 1953 when the number of staff rose to 50. Since then improvement and expansion of production have been rapid and now besides cortisone acetate, the principal corticosteroid substances include hydrocortisone alcohol and acetate, prednisone and prednisolone.

The processes involved have been gradually and steadily developed. The staff now number 150 and the plant satisfies a high proportion of the UK demand for cortisone and related substances.

The factory site extends to 12 acres. A further 16 acres could be made available for further expansion. The factory is self-contained with engineering, accounts, analytical chemistry, personnel and process investigation departments.

Another pharmaceutical company with its headquarters in England is *Organon Laboratories Ltd.*, of New Edinburgh Road, Newhouse by Motherwell, Lanarks. The main chemicals produced represent a complete range of steroid and trophic hormones. In addition to large scale production of hormones and cholesterol the factory produces and packs for distribution to home and export markets a wide range of ethical pharmaceutical hormone specialities, plus many other ethical pharmacentical speciality products. The company is also active in the cosmetic field with its hormone cream Endocil.

Calls for increased production are met by changing to a three-shift system or by raising capacity of existing plant.

Roche Products Ltd. brought a new modern plant at Dalry, Ayrshire, for the large scale synthesis of vitamin A, into production last year. The first batches of synthetic vitamin A acetate were made and production has been gradually stepped up so that now the plant is working to full capacity producing high potency acetate and palmitate concentrates. Under normal working conditions, output of synthetic vitamin A concentrates amounts to at least 40 million million IU during a full year.

Oils distillation unit of the silicones plant at ICI Nobel division's Ardeer factory, Stevenston

Boots Pure Drug Co. Ltd., Station Street, Nottingham, maintain an encapsulating and tabletting section at their Airdrie Works, but they do not manufacture pharmaceutical chemicals in Scotland.

A long-established firm of manufacturing chemists is *T. and H. Smith Ltd.*, Edinburgh, founded in 1827, and well known for their alkaloids, particularly opium alkaloids. The extraction, purification and marketing of these naturally ocurring principles form an important part of the company's business. Many other pharmaceuticals and a complete range of BP and BPC galenicals are also produced. A range of medical specialities is marketed under the label of Duncan Flockhart and Co. Ltd., the merging of the interests of these two old pharmaceutical houses having taken place a few years ago.

An early result of the post-war reseach programme was the development of the total synthesis on a full commercial scale of the alkaloids, atropine, homatropine and hyoscyamine. Apart from the importance of this work in itself—it provides an alternative to the extraction of these drugs from vegetable sources—it has led to the preparation and screening of a number of related compounds. The most interesting of these so far is homatropinium phenacyl chloride, a short-acting hypertensive. This has recently been made available to surgeons and anaesthetists as Trophenium. Its use reduces bleeding during surgery.

For several years, one of the trading estate factories at Chapelhall, near Glasgow, has been used for breaking bulk and packaging the company's products for distribution to retail chemist customers in Scotland, wholesale customers throughout the UK and many overseas markets.

Recent developments on the part of *J. F. Macfarlan and Co. Ltd.*, 109 Abbeyhill, Edinburgh 8, have been largely in improved methods and increased production of their older products, such as the alkaloids of opium and the anaesthetics ether and chloroform. Founded in 1780, this company has also introduced Neothyl brand of methyl-n-propyl ether, a new general anaesthetic which is claimed to show considerable advantages over diethyl ether and Lignocaine, a local anaesthetic produced in the company's own laboratories.

A branch of *Parke, Davis and Co. Ltd.* was opened in August 1954, at Carfin, Lanarks, to improve distribution facilities for certain areas in Scotland and the North of England. Since then, the Carfin branch has taken an increasing part in the preparation of certain solutions and packing of Parke, Davis products, in addition to acting as a distribution centre for Scotland.

Apart from its chemical manufacturing activities, Scotland also houses a number of large research establishments. Among chemical firms, there are the big research departments of ICI's Nobel and dyestuffs divisions, at Ardeer and Grangemouth respectively; the Airdrie establishment of *Boots Pure Drug Co. Ltd.* and the research units of the Scottish pharmaceutical manufacturers. A new enlarged laboratory unit was opened recently at Heathall, Dumfries by the *North British Rubber Co. Ltd.*

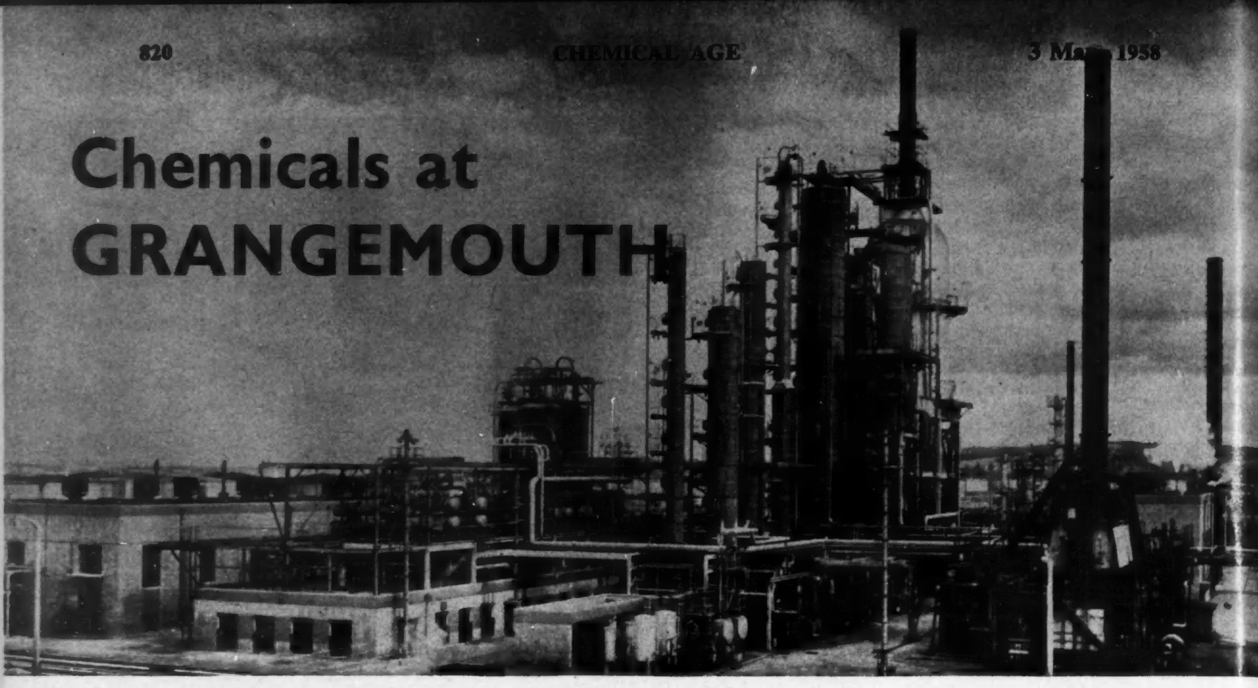
The largest research facilities in Scotland are probably those at Dounreay for the *UK Atomic Energy Authority.* This new fast breeder research reactor is supported by extensive chemistry and physical laboratories.

A number of the leading English chemical companies maintain sales offices in Scotland. Among them are the *Shell Chemical Co.*, whose Scottish sales division is at 124 St. Vincent Street, Glasgow, C2. Based here is a team of representatives who handle Shell's chemicals for industry.

F. W. Berk and Co. Ltd. have a sales office at 65 West Regent Street, Glasgow C2, and *Brotherton and Co. Ltd.* maintain a store at 229 Castle Street, Glasgow C4. *Albright and Wilson Ltd.* also have a sales branch office in Scotland, at 75 St. George's Place, Glasgow C2.

J. M. Steel and Co. Ltd., suppliers of a varied range of industrial chemicals, opened a regional sales office last October at 144 St. Vincent Place Street, Glasgow C2.

Chemicals at GRANGEMOUTH



BP Refinery Supplies Important Raw Materials

IN its operations in Scotland the British Petroleum Company plays four distinctly separate roles. Broadly speaking, the first concerns the refining of crude oil from the Middle East, which is carried on at Grangemouth Refinery on the Firth of Forth; secondly, in partnership with other companies BP is interested in petrochemical production from plant adjoining the refinery; thirdly, through a subsidiary company, Scottish Oils Ltd., it mines oil shale and processes the oil derived from it. The latter is one of Scotland's oldest industries, older than the oil industry itself; in fact, oil was being produced from shale in Scotland some years before the first oil well was drilled in America in 1859. And, fourthly, through Scottish Oils and Shell-Mex Ltd., BP products are distributed throughout Scotland.

Grangemouth Refinery stands on the south bank of the Firth of Forth on a 412-acre site near the important seaport town of Grangemouth. At present it can process 2,200,000 tons a year of crude oil, but, towards the end of last year an expansion project was started which, when completed in 1959, will raise the throughput capacity to 3,200,000 tons annually.

There has been an oil refinery at Grangemouth since 1924 when a crude oil distillation unit, plant for the separation of kerosene from motor spirit, and treatment units for the refining of motor spirit and kerosene were erected. The young refinery technician of today would hardly recognise the early equipment, but at the time it represented the most modern equipment available.

In 1930 two cracking units were added to produce an improved grade of motor spirit, and a solvent extraction unit was installed to produce a superfine lamp oil and tractor vaporising spirit.

Until the Second World War the refinery operated at the modest production figure of 360,000 tons a year. Because of the lack of supplies of crude oil during the war it was shut down for some time and only recommenced operating in 1946.

The growing demand for oil products in Scotland after the war, and indeed throughout the world, made it necessary for BP not only to enlarge the refinery but to remodel it. Work on this project began in 1949. The whole of that year was spent in making foundations, laying underground drainage and pipelines, building roads, and moving certain sections of the old refinery to new positions to make way for new plant.

In view of the difficulty of obtaining materials at that time, capacities could at first only be increased by the adaptation of existing units for other duties. The two cracking units which were erected in 1930, for instance, were converted for crude oil distillation, and by this means the refinery's capacity was raised from 360,000 tons a year to 600,000 tons.

With the installation in 1951 of a new distillation unit, the refinery's original target throughput of 1,800,000 tons a year was achieved. But by this time Abadan Refinery, in Persia, had closed down and this gave a boost to Grangemouth's expansion scheme. Capacity was stepped up to 2,700,000 tons a year, primarily by means of plant adjustment. Over the last year or two annual throughput capacity has steadied at 2,200,000 tons. In addition to the new distillation unit, other plant including a catalytic cracking unit, was installed, the whole project being completed in 1954.

General view above of catalytic cracking plant at the BP Grangemouth oil refinery

With the world demand for oil products continually increasing, it was realised that the 1951 expansion would by no means be the last. Consequently the main refining areas were designed and sited with a view to later expansion. In 1957 it was decided that the refinery's annual throughput should be increased to 3,200,000 tons and this work is now under way.

To effect this increase a new crude oil distillation unit is to be erected. This will replace part of the present distillation plant. Associated with the new distillation unit will be a copper chloride unit, a de-ethaniser, which will increase the quantity of propane produced, and gas oil and kerosene treatment units. A new boiler is to be erected and, in addition, an electric generator of 2,250 kW capacity driven by an experimental gas turbine, which will be installed in the power house. The erection of a number of tanks of various sizes, and extensions to present product loading facilities will complete the project. It is expected that the new distillation unit will be completed early in 1959 and the whole scheme later that year.

Grangemouth has the distinction of being at the receiving end of the longest commercial oil pipeline in the United Kingdom. All crude oil for the refinery is pumped ashore from tankers at Finnart, on the west coast of Scotland, and conveyed through a 57-mile pipeline to the tank farm at Grangemouth. From there it is pumped to the crude oil distillation unit, where the oil is heated by being passed in tubes through a furnace and thence through a series of distillation vessels, tall vertical steel towers in which temperature and pressures are carefully controlled.

In the first two towers light gasoline or petrol is drawn off and passed to the

depropaniser and debutaniser towers, where propane and butane gases are removed. Butane gas, liquefied under pressure, is marketed in small, easily portable cylinders for use as a household fuel in rural districts where there is no main gas supply. Before being made up into cylinders the gas is treated with tannin solutiser solution to remove sulphur compounds which would give it an objectionable odour when burnt. Propane is filled into larger containers and is used for industrial purposes.

The feedstock next passes to the main distillation tower where benzene, naphtha, kerosene, light gas oil, heavy gas oil and residual fuel oil are separated. The last three products require no further treatment apart from blending. The light gasoline from the first two towers and the benzene from the main tower are treated with caustic soda and copper chloride and finally blended with spirit from other processes to give the correct octane rating for motor fuel. A proportion of the naphtha is used in kerosene treatment.

Raw kerosene is first filtered through bauxite and then passes to the solvent extraction plant where it is mixed with liquefied sulphur dioxide. This chemical separates the paraffins, the compounds of which have good burning properties, and the aromatics, which are unsuitable for burning but are valuable as internal combustion engine fuels. The paraffins are treated with acid and soda and re-filtered through bauxite. Two grades are produced; the ordinary burning oil commonly retailed in this country as 'paraffin oil', and the premium grade oil which burns for a longer period without attention and is therefore suitable for use in, for instance, incubators and greenhouse heaters.

Aromatics Separated

Aromatics are separated from the solvent, re-distilled and treated with acid and soda to produce a blending stock for vaporising oil as used in agricultural tractors.

An important addition to this series of processes is the catalytic cracking plant which converts the heavier oils into high grade motor spirit. The principle of the cracking process is that by means of pressure and great heat the relatively heavy hydrocarbon molecules present in heavy oils are broken up into the lighter molecules which are found in motor spirit and petroleum gases. When this process is performed in the presence of a catalyst, better results are obtained at lower and more easily controlled temperatures and pressures. In a fluid catalytic cracker, such as the one installed at Grangemouth, the catalyst in finely powdered form circulates through the reaction chamber as if it were a fluid. Coke which is deposited on it, is burned away in a separate chamber and the hot catalyst is re-circulated over and over again.

In addition to motor spirit the cracker also produces a considerable quantity of gas which is first passed to the Girbotol plant which removes its hydrogen sulphide content. The gas is then passed to the polymerisation unit, where, by heat and pressure and the use of a suitable catalyst, the cracking process is reversed, the light unsaturated molecules of gas being made to combine and provide a further yield of high octane hydrocarbons useful for motor spirit blending. This plant also produces tetramer, which is piped to the British Hydrocarbon Chemicals plant for use in the manufacture of petrochemicals.

The hydrogen sulphide extracted by the Girbotol plant is passed to the sulphur production plant where it is converted into flake sulphur. This sulphur is transported by road to Broxburn acid works, where it is manufactured into sulphuric acid for use in the chemical industry.

After the various products have been blended to meet market requirements, they are pumped to the tank farm for storage. Tanks used for motor spirit, kerosene and crude oil storage are fitted with floating roofs which prevent air entering the space between the liquid level and the tank top and forming a dangerous vapour.

Despatches are made by road or rail tank cars and by sea. The nearby jetties, which were originally installed for delivery of crude oil, are now used for outgoing traffic, either by coastal tankers or ocean-going vessels up to 12,500 tons capacity. With the expansion of BP's Grangemouth refinery since the Second World War there has developed a flourishing and to all intents and purposes, all-British, petrochemical industry in this part of Scotland. BP's activities in this field are dealt with in the article which follows.

Three Companies Make Wide Range of Petrochemicals

A THRIVING petroleum chemicals industry has been built up adjacent to British Petroleum's Grangemouth refinery and today the refinery is the central source of raw materials for use in the manufacture of a variety of petroleum chemicals.

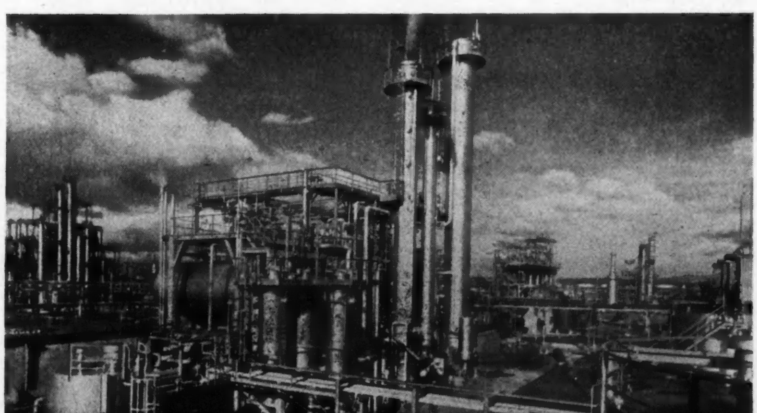
In 1947 British Petroleum Chemicals Ltd. (now British Hydrocarbon Chemicals Ltd.) was formed in equal partnership between The Distillers Co. Ltd., and British Petroleum Co. to produce chemicals from petroleum at Grangemouth. Both the parent companies had previously conducted much research in the petroleum chemical field and, with the complete remodelling and extensions of BP's Grangemouth refinery, an opportunity was afforded for the development of an all-British petroleum chemicals industry.

The first petroleum chemicals units at Grangemouth came into operation in 1951. By cracking a petroleum distillate supplied by the refinery the new plants produced two olefine gases, ethylene and propylene, and, as a first stage in their utilisation, converted them into ethyl and isopropyl alcohols.

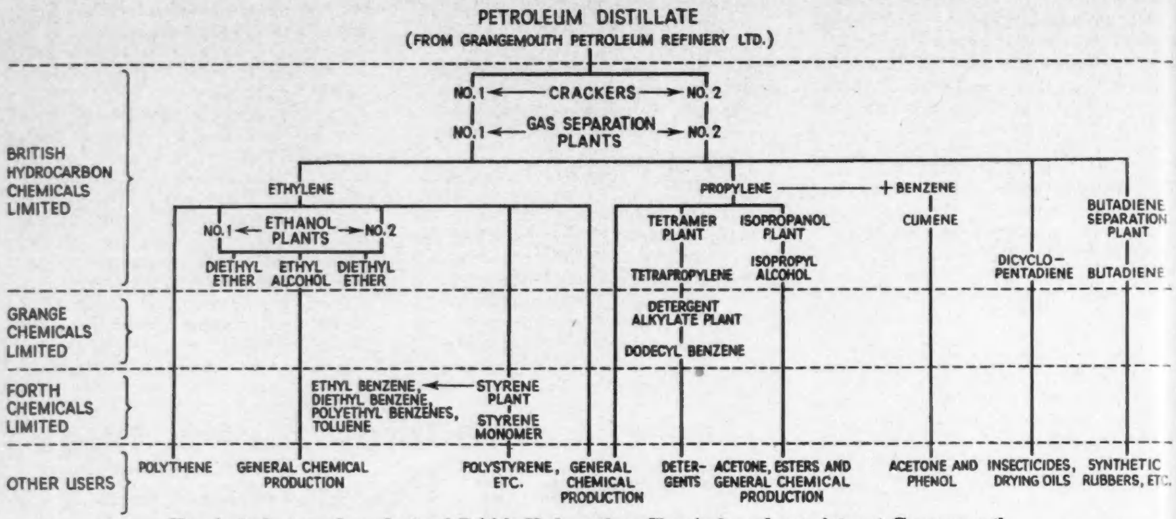
In the meantime the rising demand for plastics materials had led to a second development. In April 1950, British Petroleum Chemicals Ltd. (to use its name at that time) and Monsanto Chemicals Ltd. formed a new joint company, Forth Chemicals Ltd. The object of this company was to produce monomeric styrene, a chemical intermediate used in the manufacture of polystyrene and for a number of other industrial uses. Plant was erected and brought into operation in 1953. It has since been expanded to over three times its initial designed capacity.

In January 1955, a third company was added to the group, with the formation of Grange Chemicals Ltd., jointly owned by British Hydrocarbon Chemicals Ltd. and Oronite Chemical Co. of California (a subsidiary of Standard Oil Co. of California). The Grange Chemicals plant, which was sited within British Hydrocarbon Chemicals area, was completed at the end of 1955 and produces detergent alkylate (dodecyl benzene), an intermediate for the manufacture of high-grade synthetic detergents.

To meet the needs of these subsidiaries



Centre foreground in this view of British Hydrocarbon Chemicals plant is the purification and rectification No. 1 ethanol plant; left foreground is the fractionation No. 1 ethylene plant; and right foreground, isopropyl alcohol and detergent alkylate plants



Chemical plants and products of British Hydrocarbon Chemicals and associates at Grangemouth

and to satisy other demands, expansion of British Hydrocarbon Chemicals' plant became necessary and during the past year new plant to duplicate the existing cracking and gas-separation plant for olefin production has been commissioned. Ethylene manufacture is now at the rate of 60,000 tons a year. The greater part of this ethylene is used for the manufacture of industrial alcohol, the plants for which have also been substantially increased, as also that of Forth Chemicals. Some ethylene is sold to Union Carbide Ltd. for the manufacture of polyethylene by Gemec Ltd., at Grangemouth.

A butadiene plant was commissioned in December 1956, and the liquefied product is now being shipped to producers of synthetic rubbers and other polymers, both in this country and on the continent. Another plant commissioned in March 1957 by British Hydrocarbon Chemicals is a large catalytic polymerisation unit, for the manufacture of propylene tetramer, one of the main feedstocks for detergent alkylate which is manufactured by Grange Chemicals Ltd. It also provides a surplus for sale to other manufacturers.

The three companies, British Hydrocarbon Chemicals, Forth Chemicals and Grange Chemicals, produced over 150,000 tons of chemical intermediates during 1957, in addition to high-grade motor spirit and other hydrocarbon by-products.

Work on new plant is going steadily ahead at Grangemouth. It was recently announced that synthetic phenol, one of the most important primary materials for the plastics and organic chemicals industries, is to be made on a large scale by British Hydrocarbon Chemicals Ltd. The new plant will use a process developed in Great Britain by The Distillers Co. Ltd. Cumene will be made from benzene and propylene. In the subsequent conversion of cumene to phenol, acetone, which is an important industrial solvent and chemical intermediate, will also be produced. It is hoped to commission this plant during 1959. Cumene will also be available for sale to other chemical manufacturers.

Good progress is also being made with the British Hydrocarbon Chemicals' project to make polyethylene, using the Phillips low-pressure process. The capacity of the new plant will be about 12,000 tons a year. This plant is also due to be commissioned sometime during 1959.

The total cost of these two projects, both of which are due to be completed in 1959, will be about £8 million. This will bring to over £25 million the amount that British Hydrocarbon Chemicals Ltd., direct or through its subsidiaries, will have expended at Grangemouth, but this is only a portion of the total capital cost of all the Grangemouth petroleum plants, making up one of Scotland's biggest and most important industries.

Forth Chemicals Ltd. produces one main product, styrene monomer, which is sold to other chemical manufacturers for polymerisation into polystrene; and for the production of general purpose rubbers and other copolymers with butadiene; for polyester resins; for ion-exchange resins and for styrenated paints. Selling prices have been consistently reduced and the company reduced the selling price of styrene monomer by a further £5 per ton in December last year. This reduction was made possible by Forth Chemicals' increased scale of production. Output is 30,000 tons a year. The greatly expanded plant has resulted in marked economies in production costs which are being passed on to the consumer.

Other chemical materials are available from Forth Chemicals. Ethyl benzene produced in stage one of the styrene reaction is now offered for sale in limited quantities as an intermediate. Diethyl benzene (a mixture of *o*-, *m*- and *p*-isomers) finds application in certain specialised printing processes and as a diluent in the surface-coating industry. Polyethyl-benzenes have also found some application as diluents in the surface-coating industry, and as solvents for insecticides such as DDT and dieldrin.

As has been noted, production of detergent alkylate (dodecyl benzene) is the main activity of Grange Chemicals Ltd. It is produced by reacting tetrapropylene, supplied partly by British Hydrocarbon Chemicals and partly from the adjacent plant of BP Refinery (Grangemouth) Ltd., with benzene acquired from indigenous coal tar sources. Certain by-products arising from the process are marketed for chemical type applications or are disposed of usefully in the operations of the factory and the adjacent refinery.

The alkylate is sold under the trade name, Grange Alkane, being distributed directly by Grange Chemicals Ltd. in the UK and through agents in a number of overseas markets. The customer processes Grange Alkane to a sulphonate slurry, from which is obtained the basic ingredient for household and industrial synthetic detergents. Until recently, sulphonation was carried out by reacting the detergent alkylate with sulphuric acid. However, an improved process uses gaseous sulphur trioxide, and is stated to have many advantages over the older method, and for this modern technique Grange Alkane is reported to have proved particularly suitable.

Grange Chemicals act as sales agents for tetrapropylene produced by British Hydrocarbon Chemicals which is surplus to Grange's own requirements, and a large tonnage of this material is disposed of annually to customers at home and abroad. The company has also been given the sales agency in the UK for Oronite Chemical Co.'s new product Oronite Isophthalic. According to reports, this has been found to be more than competitive with phthalic anhydride in many applications of resin manufacture, particularly for the paint and varnish industry.

A feature of British Hydrocarbon Chemicals is the automatic and electronic control of the production units. The analytical laboratories, where the most modern techniques of analysis and inspection are used, also perform a service for the routine control of the plants of Forth Chemicals Ltd. and Grange Chemicals

Ltd. British Hydrocarbon Chemicals have also established a separate research department for which a new laboratory has recently been completed, to assist in studies of special problems affecting existing processes and production, but mainly to carry out research and investigations leading to the development of new processes and chemical products.

The group of chemical factories uses very large amounts of steam, electricity and cooling water. To meet this demand seven induced-draught cooling tower cells and a natural-draught tower have been installed. The addition of a natural-draught tower, now under construction, will bring the total cooling water capacity from approximately 2¼ million gallons per hour to 3¾ million gallons per hour.

ICI'S DYESTUFFS PLANT WAS ESTABLISHED IN 1919

THE large dyestuffs division plant of ICI Ltd. at Grangemouth has its origin in the days of the first world war when the UK, dependent for its dyestuffs on Germany, had its supplies cut off. James Morton, a high quality dyer who relied on fast German dyestuffs decided to make dyestuffs himself. Despite difficulties production was started at Carlisle by his small company, Solway Dyes Co.

Business was so successful that by 1919 Morton needed a larger factory and chose Grangemouth, site of the present ICI plant. Many of the ex-miners that he employed are still working at the Grangemouth works. A major early setback was the Government decision in 1920 and 1921 to take huge quantities of dyestuffs as part of Germany's reparation payments. Some £7 million worth of dyes, equal to more than three years' normal supply for Britain were imported.

The tide began to turn with the start-up of the phthalic anhydride plant and the making of many important intermediates from that starting material without having to use the expensive anthraquinone. This led to establishment of the process for Caledon Blue RC, still one of the most important dyes made at Grangemouth. One of the earliest discoveries to come from Morton's team of organic chemists was Caledon jade green, a new bright green vat dyestuff, that was almost completely fast to light and washing, far surpassing any previous green dye in those respects.

That dyestuff was and still is made in vast quantities; this discovery, more than any other, set the seal for Britain's renaissance as a major dyestuffs producing country. Another oustanding Grangemouth contribution was made in 1925 when research workers made a soluble form of Caledon jade green. In 1928 Monastral fast blue, one of the brightest and fastest pigments produced, was discovered.

Also from Grangemouth in the mid-20's came the Duranol dyestuffs, a development that made possible the satisfactory dyeing of acetate rayon. More recently this range has proved invaluable in the dyeing of nylon and other new synthetic fibres.

Morton's company now known as Scottish Dyes Ltd. was acquired in 1928 by the British Dyestuffs Corporation Ltd., one of the four companies that had amalgamated two years earlier to form ICI Ltd. BDC became dyestuffs group (now dyestuffs division).

The benefits of a vigorous policy of research coupled with replanning and modernisation were seen when, with the second world war, the UK and most of the world were once more cut off from supplies of German dyestuffs. The UK industry was able to meet all the essential needs of Britain and her allies in addition to vastly increasing its supplies of other essential chemicals.

After the war, another product of importance was Aphrosol FC, a foaming agent for foamed cement and concrete. Recently, Grangemouth works have been very much involved in the development of some of the members of the new type of synthetic dyestuffs, the Procions. Easier to apply than normal vat colours, these have excellent fastness to washing and to light.

Also produced at Grangemouth are a range of wool dyestuffs, including Solway, Lissamine, Coomassie and Carbolan. The Duranol range first produced for acetate rayon is now of increased significance because of its use in dyeing nylon and Terylene. Insoluble in water, these dyes are applied to the fibres in the form of extremely fine dispersions in water. The minute suspended particles of solid dyestuff are believed to dye the fibres by dissolving in them to form 'solid solutions'.

Other dyestuffs include several of the Waxoline range used for colouring oils, waxes, petrol, etc. and for smoke recognition signals.

In the pigments field, ICI Grangemouth has only a relatively small number of products to show. The important phthalocyanine pigment Monastral fast blue B referred to earlier, is now produced in a large new plant in another of the dyestuffs division's factories. Two related products—derivatives of the first product and possessing the same fastness properties—are, however, made at Grangemouth and used for paints, printing inks, linoleum, leathercloth, etc.

The production of medicinal products started in 1942 with the manufacture of sulphanilamide and the antimalarial drug mepacrine. By 1945 many millions of mepacrine tablets were being turned out every week. Since the war, the range of medicinals has been greatly extended. The technical know-how and experience necessary to produce dyestuffs are the same as those needed for the production of synthetic drugs and medicinals.

Further sulpha drugs, such as sulphaguanidine and sulphamezathine are now being made, while two new antimalarial drugs, Paludrine and Chloroquin, superior to mepacrine, (and discovered in ICI laboratories) are in regular production. Also being produced at Grangemouth are Antrypol for use in combating sleeping sickness, certain intermediates necessary in the manufacture of Antrycide, used to control trypanosomiasis in cattle, Mysoline for the treatment of epilepsy, Avlosulphon for use against leprosy (all ICI discoveries), as well as flavines for use as general-purpose antiseptics, Cetavlon bactericide for the treatment of dirty wounds, and the gaseous anaesthetic cyclopropane, noted for its freedom from undesirable after-effects.

Under development and expected soon to reach the manufacturing range are a new powerful antiseptic and other drugs resulting from large-scale research.

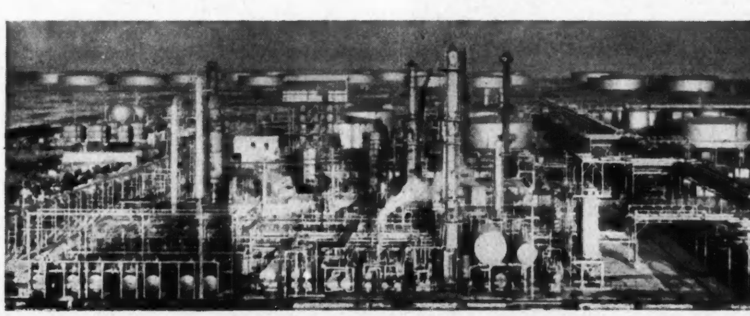
Medicinal Field Activities

The extension of the plant's activities into the medicinal field has been welcomed as a stabilising factor likely to promote greater uniformity of activity, particularly with the prospect of fiercer competition with freer trade in Europe.

To complete this product survey, Grangemouth works also produce textile finishing agents and processing assistants; phthalic anhydride, widely used for synthetic resins and plasticisers for resins and more recently its use in the form of an ester as an insect repellant; tanning agents for leather; and a number of intermediates.

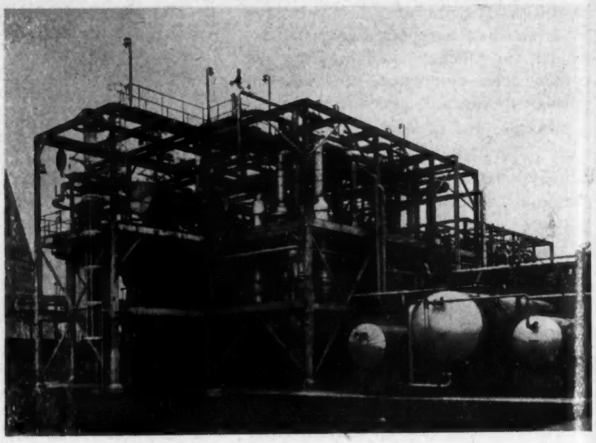
On the payroll are 2,000, including a large staff of chemists and engineers. All production is done on the shift system and of the 1,630 payroll employees some 550 are process operators, the remainder, including 180 women, being engaged on maintenance work and services ancillary

(*Continued on page* 826)



Butadiene plant with tank farm in background at British Hydrocarbon Chemicals Grangemouth plant

PLANT SUPPLIERS TO SCOTTISH CHEMICAL INDUSTRY



One of the three dehydrogenation units built by John Thompson Ltd. for Forth Chemicals at Grangemouth

Bricks for Lining Chemical Plant

Acid-resisting and engineering bricks supplied by the *Accrington Brick and Tile Co. Ltd.*, Accrington, Lancs, have been used by ICI at Grangemouth for paving work and for still linings. British Hydrocarbon Chemicals have used Accrington materials, both bricks and blocks, for linings to hydrolysers, concentrators, vapour pipes, flooring and acid resisting rings for tower packing.

The BP refinery uses Accrington multi-coloured sandfaced bricks for the outside of its chimneys and acid-resisting bricks for the internal linings.

British Oxygen Gases

Equipment and gases supplied by *British Oxygen Gases Ltd.*, Bridgewater House, Cleveland Row, St. James's, London SW1, are used by many contractors and manufacturers at Grangemouth.

Forth Chemicals have a liquid nitrogen plant and pipeline and the nitrogen is used for blanketing the styrene which is sent to Monsanto in South Wales. Argon is used by British Hydrocarbon Chemicals for Argonaut welding of non-ferrous metal components of plant. Nitrogen has been supplied to Gemec Ltd., although they have since purchased a nitrogen producing plant of their own.

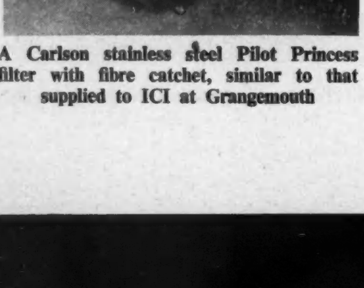
Acid and Caustic Resisting Valves

Audco lubricated plug valves have been supplied to British Hydrocarbon Chemicals Ltd. at Grangemouth by *Audley Engineering Co. Ltd.*, Newport, Shropshire. Ten per cent caustic at 200°F is being handled by 2-in., 3-in. and 4-in. valves and type SR (sulphate resisting) are used in the 96 per cent H_2SO_4 lines in the acid recovery plant.

Six 4-in. class 300 carbon steel Hypreseal type valves, sometimes referred to as block valves, are installed in the lines from the propylene feed pumps to the condensers. The service is 80 per cent liquid propylene, 20 per cent diethyl ether and alcohol, 0.5 per cent H_2SO_4 and 0.25 sulphur dioxide at 140°C.

About 100 one-in. cast iron standard Audco valves with diamond ports are installed on each of the two ethylene plants and over 600 cast iron and classes 150 and 300 carbon steel valves on the two ethanol plants. The latter include standard and Hypreseal type valves of short, overall and multiport patterns. Sizes from ½ in. to 4 in.

Thirty Audco valves are installed on the butadiene plant in sizes ranging from 2 in. to 6 in. and including both wrench-and gear-operated class 300 carbon steel valves.



A Carlson stainless steel Pilot Princess filter with fibre catchet, similar to that supplied to ICI at Grangemouth

Ammonia Compressors

Two-stage double acting ammonia compressors and ancillary plant were supplied to Kellogg International Corporation Ltd. for British Hydrocarbon Chemicals at Grangemouth by *Peter Brotherhood Ltd.*, Peterborough.

The refrigerating plant consists of two motor-driven two-stage double-acting ammonia compressors with intercoolers, oil separator, ammonia condenser and receiver, liquid precooler, suction traps, non-condensible gas purger and storage receiver.

Belting and Hose

Conveyor belting and suction hose has been supplied to ICI at Grangemouth by *BTR Industries Ltd.*, Herga House, Vincent Square, London SW1.

Carlson Filters

Equipment supplied by *John C. Carlson, Ltd.*, Newman Street, Ashton-under-Lyne, Lancs, to Imperial Chemical Industries at Grangemouth are two Carlson Pilot Princess filters constructed in stainless steel. Carlson original filter sheets are also supplied to the plant.

The filters supplied find application in the preparation of pharmaceuticals. Filtration in this industry falls into two classes, i.e. clarifying and sterilising. Carlson stainless steel filters are designed for handling liquids where resistance to corrosion is of importance, as all parts which come into contact with the liquid, are manufactured in stainless steel.

Pilot Princess filters are available with mounted pumps, or as table models—as supplied to ICI—and are also constructed in a highly durable aluminium alloy, lacquered or anodised, and Nolac, a non-corroding light alloy which does not require protective lacquering. These filters operate with 20 cm. filter sheets and have an output of about 100 gallons per hour, depending on the liquid to be handled and the number of filter plates to be used.

Valves from Cockburns

Products of *Cockburns Ltd.*, Clydesdale Engineering Works, Cardonald, Glasgow, include valves and ancillary equipment for chemical, petrochemical and oil refinery plants.

Factory extensions at Cardonald will involve the utilisation of 40,000 sq. ft. of space in two bays adjacent to the present factory. This extension will be used for the manufacture of steel and non-ferrous springs and production is scheduled to begin in September.

Side Entry Mixers

Joshua Greaves and Sons Ltd., Irwell Street, Ramsbottom, Manchester, supplied side entry mixers to E. B. Badger and Sons Ltd. for installation at Grangemouth these are fitted with mechanical seals, Metastream flexible couplings, Bruce Peebles flameproof motors and stainless steel propellers.

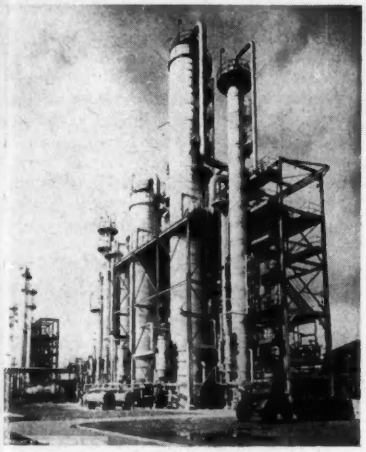
Lurgi High Pressure Coal Gasifier

The first Lurgi high pressure coal gasification plant in the UK is to be built at Westfield, near Loch Leven, Fife, by *Humphreys and Glasgow Ltd.*, Humglas House, Carlisle Place, London SW1. In addition to providing gas for industrial and domestic use in Scotland this will also produce ammonia and benzole as by-products.

To cost £6.5 million the plant will have a capacity of 30 million cu. ft. a day. Work on the site will begin in June.

Styrene Monomer Plant

The styrene monomer plant for Forth Chemicals was designed by Monsanto Chemicals and erected by *Matthew Hall*



The distillation area of the styrene monomer plant of Forth Chemicals at Grangemouth. This plant, claimed to be capable of meeting all present UK needs for the monomer, was designed by Monsanto Chemicals and built by Matthew Hall and Co.

and Co. Ltd., Matthew Hall House, Dorset Square, London NW1.

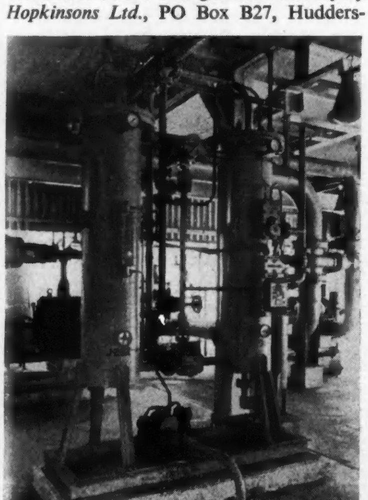
In this plant benzene and ethylene are reacted together to form ethyl benzene which is subsequently dehydrogenated to produce styrene. Total annual capacity is now over 30,000 tons.

Air Dryers

Two Holmes-Kemp air dryers were supplied by *W. C. Holmes and Co. Ltd.* PO Box B7, Turnbridge, Huddersfield, to the British Hydrocarbon Chemicals Ltd. works at Grangemouth. These are used to dry the air used to operate process control instruments.

Boiler Mountings and Stop Valves

Boiler mountings and a large quantity of stop valves of various types, some with electric control, were supplied to the British Petroleum Grangemouth refinery by *Hopkinsons Ltd.*, PO Box B27, Huddersfield, together with a large number of steam traps.



A Holmes-Kemp air dryer installed at Grangemouth

Equipment supplied by this company to Imperial Chemical Industries also included boiler mountings and valves and, in addition, soot blowing equipment.

Tower Packings in Various Forms

Large quantities of tower packings were supplied by *The Hydronyl Syndicate Ltd.*, 14 Gloucester Road, London SW7, to British Hydrocarbon Chemicals at Grangemouth.

The company supplied several million chemical stoneware balls for catalyst support in reactor vessels and Hy-Contact porcelain rings for towers of the No. 1 ethanol, ethylene and tetramer plants. The detergent alkylate plant required a range of sizes of packing elements from 2 in. to $\frac{1}{4}$ in. including a charge of carbon rings for an Oil Separator.

Extension of the plant by the commissioning of the No. 2 ethanol plant and another tetramer plant called for repeat orders for Hy-Contact porcelain rings.

Modifications to the No. 1 ethylene plant are being met by Hydronyl's recent addition to their range of tower packings—the Intalox Saddle—a type of packing that is claimed to permit high throughput without increased pressure drop. The polythene plant now in course of erection will also contain large quantities of rings and saddles of porcelain and mild steel.

New Chemical Plant Division to be opened

A new chemical plant division is shortly to be opened by *George MacLellan and Co. Ltd.*, Maryhill, Glasgow NW, in which vessels, tanks and pipes up to 26 ft. long and 10 ft. in diameter can be covered and lined.

Lining will be carried out in hard or soft rubber, Ebonite, neoprene and other synthetics. A service in which pipes or vessels are lined on site is also available. Total size of the new building, which will also contain plant for the manufacture of chemical hose, is over 40,000 sq. ft. of manufacturing space.

Sulphur Compounds Removal Plant

An H_2S and mercaptan removal plant was supplied by *The Power-Gas Corporation Ltd.*, PO Box 21, Stockton-on-Tees, to the British Petroleum refinery at Grangemouth.

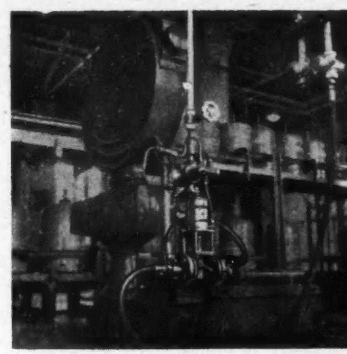
This liquid and gas Girbotol plant and mercaptan removal unit consists of facilities for treating a total of three hydrocarbon streams, two liquid and one gas, with facilities for regenerating the treating mediums. A liquid C_3 hydrocarbon stream and a catalytic cracker absorber for tail gas stream are each contacted separately with 20 per cent diethanolamine solution, the former stream being further treated by caustic and water washing.

A liquid C_4 hydrocarbon stream is first treated by caustic for the removal of H_2S traces and further treated by a continuous caustic wash for removal of mercaptans, after which it is given a water wash. A common amine reactivation section serves the liquid C_3 and tail gas hydrocarbon streams and a caustic regeneration section serves the liquid C_4 hydrocarbon caustic treated stream.

Rapid-Acting Valves

Among components supplied for the BP refinery at Grangemouth by Richard Klinger Ltd., Klingerit Works, Sidcup, Kent, are a number of air-operated Klingermatic valves, which are claimed to ensure trouble-free control in the low-pressure gas bottling plant.

These rapid-acting valves are used in conjunction with weighing machines to fill butane gas cylinders, and cut off the gas supply automatically when the cylinders are full. One test valve has been operated 640 times a day for many months without trouble or defect.



A weighing machine and a Klingermatic air-operated valve control for bottling butane gas

Other items supplied by Richard Klinger include reflex and thru-vision level gauges and screw-down gauge valves for an ethylene plant.

Flow Patterns Studied by Radioactive Tracers

A multi-channel scintillation spectrometer has been introduced by *Nuclear Enterprises (GB) Ltd.*, Bankhead Medway, Sighthill, Edinburgh 11. Short-lived radioactive isotopes (radiotracers) are used in this equipment. Normally only gamma radiation is counted and an analysis is made of the intensity and energy of this radiation.

To study flow patterns of materials a portion of the material is tracered with a gamma ray isotope. Movement can then be followed without disturbing operations. One application of this method is in catalytic cracking plants where the catalyst beads are tracered to detect deviations from the normal flow patterns. In this way it is possible to forecast and sometimes to avoid shut downs.

Another recent application is the measurement of relative loads carried by parallel pipes in refining plants.

Flow Indicators

Slight flow indicators made by *B. Rhodes and Son Ltd.*, Queen Street, Romford, Essex, have been supplied to various projects at Grangemouth. These are claimed to withstand high pressure and sudden temperature changes. They are made with cast iron bodies which absorb strain due to misalignment of pipes or to movement.

This heat exchanger supplied by Henry Balfour and Co. incorporates two tube bundles. It is fabricated in stainless clad material

New Research and Development Centre

George Scott and Sons (London) Ltd., Levenbank, Leven, Fife, a member of the Balfour group of companies, have begun work on their new research and development centre at Leven. Completion is scheduled for next spring. It will include a main pilot plant bay, separate pilot plant laboratories for size reduction with special reference to dust problems, and a completely isolated laboratory for solvent extraction with inflammable solvents, dealing with noxious gases and where radioactive material can be handled with safety.

There will also be special metallurgical laboratories and dark rooms, a corrosion laboratory, a physical chemical laboratory, a general analytical chemistry and development chemistry laboratory, two ceramic chemistry laboratories and a library and information room.

Dehydrogenation Plant and Pressure Vessels

A dehydrogenation plant comprising three units, each of which contributes independently to the plant's output, has been installed at Forth Chemicals' Grangemouth works for converting ethyl benzene to crude styrene. Several items were made for this plant by *John Thompson Ltd.*, Ettingshall, Wolverhampton.

These include vertical pre-heaters of 16 ft. length over tubeplates and of 2 ft. 7 in. internal diameter which are of welded construction, with dished ends $\frac{7}{16}$ in. thick, each unit containing 337 1-inch diameter tubes set at $1\frac{1}{2}$ in. triangular pitch. The shell, also made from $\frac{7}{16}$ in. plate, incorporates three bellows sections to accommodate the differential expansion of shell and tubes. The bellows were pre-strained to 0.088 in. during manufacture.

The operating pressure of the shell is 40 p.s.i. and its operating temperature 635°F, while the respective operating pressure and temperature of the tubes are 5.5 p.s.i. and 797°F.

With six strakes of $\frac{5}{16}$ in. thick plate forming the body and with ends constructed from $\frac{5}{16}$ in. plate, the all-welded water separators too, are John Thompson products. Thirty feet in length and of 9 ft. diameter, these vessels, conforming to API–ASME code, have a design pressure of 20 p.s.i. and a design temperature of 300°F. They were hydraulically tested to 70 p.s.i. Their function is to separate the aqueous and non-aqueous products from dehydrogenation.

Three rundown tanks for the holding of fractions produced by distillation of the products of dehydrogenation are of 6 ft. diameter and are tested to a 30 p.s.i. pressure to work at atmospheric pressure. They have a working temperature of 95°F.

The dehydrogenation plant, for the design and layout of which the engineering department of Monsanto Chemicals was responsible, is controlled from an adjacent control room. Monsanto Chemicals also supervised erection of the plant.

For the detergent alkylate plant of Grange Chemicals, a British Hydrocarbons subsidiary, now under construction at Grangemouth, a number of pressure vessels have been made which, while delivered, have not yet been absorbed into the plant. The largest of these vessels is a caustic circulating drum, constructed to class I pressure vessel standards and inspected by Lloyd's register. Conditions to which manufacture conformed were a designed pressure of 50 p.s.i., full vacuum at 400°F, and a designed temperature of 650°F. Respectively, working pressure and temperature are 5 p.s.i. and 100–200°F.

Automatically welded, this circulating drum was stress-relieved and X-rayed. Its diameter is 8 ft., length on the straight 19 ft. and overall length 24 ft. 2 in., with the shell of three strakes constructed from $\frac{9}{16}$ in. plate and dished ends from plate of $\frac{19}{32}$ in. thickness.

Three mild steel vertically-mounted feed dehydrators, constructed and tested to E. B. Badger and Sons' specification, are also John Thompson (Dudley) products which will contribute to the detergent alkylate plant. The dehydrators, made from $\frac{3}{8}$ in. plate, are 1 ft. $11\frac{1}{4}$ in. in diameter, 12 ft. in length and when completed weigh 27 cwts each. Designed for a working pressure of 50 p.s.i. and a working temperature of 90°F, the vessels are fitted with top and bottom grids made from fine and heavy mesh screens.

Engineers and constructors for the Grange Chemicals' detergent alkylate plant are E. B. Badger and Sons, of London.

New Centrifuges

Among centrifuges introduced to the chemical industry in recent years by *Watson, Laidlaw and Co. Ltd.*, 98 Laidlaw Street, Glasgow C5, is the 60-in. by 24-in. semi-automatic horizontal machine which is used for bulk treatment of materials such as sulphate of ammonia, to separate the crystals from the mother liquor. It is also available with fully automatic operation for such substances as starch.

Pumps for Handling Petrochemicals

Thirty two pumps of various types were supplied by *Sigmund Pumps Ltd.*, Team Valley, Gateshead 11, to the Grangemouth sites. Seven were bought by Gemec Chemicals Ltd. (now Union Carbide (GB) Ltd.) and the remainder by Scottish Oils Ltd.

These include seven Norma single-stage centrifugal units for sump duties, two horizontally split case pumps for motor spirit transfer, five vertical spindle pumps for drainage water and chemical drainage, 14 light process pumps for handling crude kerosene, heavy gas oil, extract tops, acid-washed kerosene, treated naphtha, extract feed, etc., and four vertical spindle pumps for oil-contaminated drainage water.

Engineering Contractors for Grangemouth Refinery

From 1947-52 *George Wimpey and Co. Ltd.*, Hammersmith Grove, London W6, carried out all the major building and civil engineering works for the new BP refinery at Grangemouth.

The main work involved in the project was a power station for the production of electricity and steam required for refinery processes. This incorporates three machines of 6,250 kW capacity. The power house is founded on four cellular flotation rafts, and this type of foundation was used extensively throughout the works where heavy loads were carried.

A tank farm of 50 acres was constructed to accommodate 25 oil tanks each 140 ft. in diameter.

Consultants for this project were Ewbank and Partners, Rendel, Palmer and Tritton, Farmer and Dark, and Kellogs International Corporation Ltd.

A polythene plant for Gemec Ltd. was started in 1955 and completed this year. The plant comprises a complete polythene unit, gas purification plant, laboratory, office building, stores, steam generating plant, cooling towers, roads and services.

Work has recently started on a contract for E. B. Badger and Sons Ltd., involving polythene and cumene-phenol plants for British Hydrocarbon Chemicals Ltd.

(1) *Polythene Plant.* This takes ethylene from an olefin plant and converts it to polythene by the Phillips low-pressure process.

(2) *Cumene.* This process starts with propylene and propane, and by the addition of benzene, produces cumene.

(3) *Phenol.* From cumene, phenol is manufactured by the addition of oxygen.

ICI at Grangemouth

(*continued from p.* 823)

to production. In the research department, investigation of new processes and development of new products is a continuous process. There is a works experimental department, linked with the day-to-day work of the factory, as well as analytical and standardising departments which carry out quality control.

Firmly established over the past 38 years, the Grangemouth works remains a young and thriving enterprise, drawing its vigour from the flourishing science of organic chemistry. Further developments are planned to meet increasing demands for the factory's products and a large area to the north of the present works has been acquired for a new building at a later date.

K. H. WILSON'S 50 YEARS WITH A & W CELEBRATED AT LONDON DINNER

At the Savoy, l. to r., Sydney Barratt, chairman, Albright and Wilson, Mrs. Barratt, Kenneth Wilson, Mrs. Wilson, Lady Worboys and Sir Walter Worboys, commercial director, ICI

FIFTY years with Albright and Wilson Ltd., 48 of them as a director and 26 as chairman, were celebrated at the Savoy Hotel, London, on Tuesday, when Mr. Kenneth H. Wilson, O.B.E., president of the company, was entertained to dinner by the directors. Among the 350 present were many of the outstanding personalities of the chemical and allied industries, of chemistry and commerce.

Mr. Sydney Barratt, chairman of Albright and Wilson, presided and introduced Sir Walter Worboys, commercial director, ICI Ltd. and Mr. R. E. Trelfall, A. and W. director, who jointly proposed the health of Mr. Wilson. Sir Walter took the place at 24 hours' notice of Sir Alexander Fleck, ICI chairman, who had a slight indisposition and was unable to attend.

Welcoming the guests, Mr. Barratt said that among them were some who had travelled from Australia, Canada, the US, Singapore, France and Ireland. All those present had some connection with Mr. Wilson, either personal or business, in some cases going back almost to the time that he joined the company in January 1908.

Sir Walter Worboys said that Sir Alexander and Mr. Wilson had been friends for almost four-fifths of Mr. Wilson's working life. It was not inappropriate that someone from ICI should propose his health. Not only did ICI through its overseas companies act as selling agents for Albright and Wilson in some 50 different territories but through ICI's Australian company, they were joint shareholders with A. and W. in Albright and Wilson (Australia) Pty. Ltd. Perhaps their real affinity was in Oldbury where the two companies had been associated since the early days.

Commonwealth visitors to the dinner and to a technical development conference the following morning, l. to r., Dr. H. W. Strong, in charge of Albright and Wilson [Australia], Mark Maunsell, vice-president and Dr. D. Jones, president, Electric Reduction Co. of Canada

Arthur Albright chose Oldbury because coal and glass (from Chance Brothers, now an ICI associated company) were readily available. From 1896 until 1942 the Oldbury works received raw materials by pipeline from Chance. In Widnes, both ICI and A. and W. had modern works. The latter received chlorine and carbon bisulphide by pipeline and from it produced sulphuric acid and returned carbon tetrachloride 'back over the wall'.

Albright and Wilson stood alone as manufacturers of phosphorus and phosphorus derived products. They also produced an increasing and impressive range of chemicals. Sir Walter mentioned that the assets of the company were £1½ million in 1932 when Mr. Wilson became chairman; today they stood at £25 million, a record of which anyone could be proud. Mr. Wilson had steered the company through considerable post-war developments at home and overseas; in 1948 he created the public company and overnight it had become a 'blue chip'.

He referred to some of Mr. Wilson's many activities both in the chemical industry and outside it. A founder-member and now life vice-president of the Association of Chemical and Allied Employers, he was also an hon. vice-president of the Association of Chemical Manufacturers. Among his many directorships were those of the British Match Corporation and Bryant and May; he had been vice-chairman of the latter since 1953. First alderman of Oldbury he was the borough's Charter Mayor in 1935. A J.P., Mr. Kenneth Wilson was High Sheriff of Worcestershire in 1948 and received the O.B.E. for public services in the following year.

Replying, Mr. Wilson said it was difficult to express in the time available what Oldbury had meant to him in the past 50 years. The early founders of the company had been imbued with the Quaker feeling for the equality of men. In 1895, pension schemes were far from universal, but Albright and Wilson founded one then. To qualify, a man's age and years of service had to total 90; the total for some reached 100 or 120 before they applied for a pension. The rate then was 50s a month; now 100 pensioners were each receiving £12 a month from the company. The scheme was non-contributory.

Concluding, Mr. Wilson said with humility that he wished he had been able to have done more in his working life.

In Parliament

100,000 Gall. Sulphur from Sludge Plant Considered

A plant for the production of sulphur from bacteria with a 100,000-gall. capacity may be installed by the Chemical Research Laboratories, DSIR and the London County Council, following the success of the 50-gall. pilot plant at Beckton. This was stated by Mr. H. Nicholls, Parliamentary Secretary to the Ministry of Works in the House of Commons on Tuesday. The new plant, under consideration by the LCC, would be used for full-scale development trials.

The process, in which calcium sulphate is added to raw sewage sludge, was not yet considered at a stage when it could be recommended to all local authorities, as they had to await results of the Beckton tests. It had proved economical in the sense that the system removed a large quantity of water, which meant that the amount to be carried away was about half the quantity it would otherwise be. Asked if sulphur was actually produced in elemental forms, Mr. Nicholls said that he would require notice of that question.

Output of Pyrethrum to be Restricted

Owing to an accumulated surplus of unsold pyrethrum and to increasing difficulties in marketing the crop, the Pyrethrum Board of Kenya has decided to restrict production. This was stated by Mr. Lennox-Boyd, Colonial Secretary, in the House of Commons last week.

Licences for the coming year will be issued largely on the basis of growers' production over the past two seasons. Any crop in excess of the amount licensed will be bought by the board at reduced prices.

DISTILLATES

On more than one occasion I have disclosed a preference for 'polythene' over 'polyethylene'. This view was based on the belief that 'polythene' was the more popular anglicised version of the term. Also it is a shorter word to write!

However, I have been 'shot at' metaphorically from time to time by chemical companies who prefer 'polyethylene' to the shortened version. The most recent is a letter from British Resin Products, now on my desk, pointing out that it was incorrect to describe their Rigidex polyethylene as polythene in our issue of 5 April, p. 644, because the term is the correct chemical description of Rigidex, which is said to differ markedly and particularly as regards softening point with conventional polethylene (originally trade-named Polythene).

Chemical Age bows, to weight of opinion. While 'polythene' will doubtless remain in the public mind as the name associated with products for retail sale, we shall settle for 'polyethylene'.

In reading the story of ICI at Grangemouth (see page 823) I was fascinated to learn something of the background of the discovery in 1928 of Monastral fast blue, described as one of the brightest and fastest pigments produced. While a batch of important chemical phthalimide was being made by bubbling ammonia gas through molten phthalic anhydride, an observant Grangemouth plant chemist noticed that it was slightly green in shade.

Such discoloration, of course often occurs in products being made on a technical scale instead of in laboratory glassware. It might well have passed without comment, but for the curiosity of the chemist concerned. He traced the impurity to contamination from a fine hair crack in the enamel lining of the mild steel pan in which the phthalimide was being made. Isolation and analysis of the trace of green impurity led to research that finally resulted in the discovery of Monastral fast blues. Today these are used in tremendous quantities throughout the world for colouring paints, printing inks, leathercloth, bookcloth, paper, plastics and other materials.

Like so many of today's commercial successes in the chemical industry Monastral fast blue is the result of a chemist's curiosity.

I have always felt, and said so a number of times in this column, that UK industry is almost pathological in its modesty. I am glad to see that Mr. J. W. Kerr, joint managing director of ICI's Billingham division rode the same hobby-horse at a recent long-service ceremony.

As a nation, said Mr. Kerr, we create the worst possible publicity for our country. We convince ourselves of our own inferiority and we cannot be surprised if someone on the Continent tells us that we are living in the past. Yet overall production in this country increased by one-third in the last 10 years, exports were double the pre-war level and sterling is still financing nearly half the world's trade.

Despite the impression created by some newspapers, the time lost through strikes is only one-tenth of the time lost through industrial accidents and less than one-hundredth of the time lost by sickness. But it is not only as a nation that Britain must publicise itself. The UK chemical industry is one of the most progressive in the world; its achievements in process techniques and in its laboratories are the keystone of Britain's technical advancement in many other fields. British chemical manufacturers are beginning to shed their traditional modesty, but only very slowly. This false modesty is utterly wrong.

I am convinced that most of this modesty stems from a long-held belief that it is impolitic to let your competitor know what you are doing. In these days of modern communications and industrial services, a manufacturer often knows what his competitor is doing before the news has filtered down through the company to junior levels.

This aura of secrecy, valid in only a few projects, is extended to matters that do not merit it merely because so many people today are still hypnotised by the jargon of wartime security. This fear of letting the other man know what you are doing does a great disservice to British achievement and serves the dual purpose of not letting your potential customer know what you are doing.

With the prospect of fiercer competition in Europe, it will behove all chemical companies to give the fullest possible publicity to their successes. A number of concerns have publicity officers, but their job is often the uphill one of convincing executives of the value of publicity.

There are many ways of keeping roosting birds off the ledges of buildings. The detonation of fire crackers and poisoning are two somewhat drastic methods. Then there is the recording of a starling in distress played through a loudspeaker system. Yet another dramatic treatment is give these birds an electric shock with a wire and a wet-cell battery.

But the most effective way of dealing with this menace, according to Mr. W. P. Sweeney, a director of Agricultural and Industrial Coatings Ltd. of Queen Street, London EC4, is to use a new chemical compound called Scarecrow developed by his company.

He tells me that Scarecrow, which is nearly colourless, can be easily brushed on to surfaces to be protected without harming the stone or paint work. The coating acts as an irritant. It has no harmful effect on the birds—it just makes their ledges unpleasant to settle on.

The RSPCA has not objected to its use, despite country-wide use. Latest customer for Scarecrow is British Railways, who have used it for the starling-proofing of Huddersfield and Bradford stations. If the coating is as successful as early results indicate, it will be used on other railway stations throughout the country.

With the opposition of British Celanese to the renewal of the two Terylene patents owned by Calico Printers Association fresh in my mind (see Chemical Age, 26 April, p. 770) I found it interesting to read the comments of Dr. A. Caress, ICI fibres division chairman, in the April issue of *ICI Magazine*. Dr. Caress tells the story of how the company became interested in Terylene and stresses the vast amount of money invested in the project. The first £10 million plant made 11 million lb. of Terylene a year, in other words, nearly £1 capital invested for every pound of product a year.

He stresses the delicate and important calculation of market demand. Output jumped from 11 to 22 million lb. a year; this is being rounded off to 30 million lb. and an extension will bring capacity up to 50 million lb. by 1960. A spinning plant is being considered for Northern Ireland in 1960.

If the jump in output is made too soon, the company would be, with all those millions of pounds' worth of plant, carrying depreciation but not selling to capacity, in the red much longer than if the jump is made too late and a smaller plant is working flat out, with business lost to competitors because of inability to satisfy the market.

Dr. Caress said that ICI workers had discovered a new route for making the intermediate chemical terephthalic acid quite recently, but were beaten to the post by a US company. ICI have made an arrangement with them which 'may lead to our using this important process in Terylene III'.

Alembic

MANDERSTAM'S LEADING ROLE IN NEW MIDDLE EAST PROJECT

DIRECTOR of operations for the newly formed Middle East Industrial Development Projects Corporation SA(MIDEC) is Mr. L. H. Manderstam, a director of L. H. Manderstam and Partners Ltd., 38 Grosvenor Gardens, London SW1.

Mr. Manderstam, who left this country on 23 April, will be based in Beirut with offices at Union Nationale Building. He

L.H. Manderstam director of operations

will be responsible for screening projects suggested by the commercial interests in the Middle East or by members of MIDEC in the area.

Initial members of the board of directors of the corporation are: Mr. Paul Rykens, The Hague (Chairman), Mr. K. A. Belfrage, Stockholm, Mr. H. Christiansen, Copenhagen, Mr. H. P. Crombe, Brussels, Mr. H. Furuholmen, Oslo, Sir Andrew MacTaggart, London, Mr. A. N. Overby, New York, US, Dr. A. Peccei, Rome, Mr. O. Wolff von Amerongen, Cologne.

It is anticipated that additional directors will be appointed by countries in the Middle East and Europe, and such countries are to have proportionate representation on the board.

The aim of MIDEC, which is registered in Luxembourg, is to stimulate the inauguration of new, and the development of existing, industrial and commercial companies in the countries of the Near and Middle East. MIDEC will participate in such ventures as well as others and will also manage and develop its own investments. It will investigate suitable projects in various countries in the Near and Middle East to establish operating companies wherever feasible.

Local investors will hold the majority of equity capital in such companies. European and American investors including MIDEC will have a minority holding. Managerial and technical advisers will be provided by MIDEC if and when required.

It is intended that MIDEC, for its services, should receive a 5 per cent participation in the equity capital of any operating company, to the establishment of which it has been incidental.

Active and close co-operation with Arab private interests is stated to be the primary consideration of the company and this object will be furthered by encouraging direct participation by Arab enterprises in MIDEC's capital and management.

The following companies are participating in this new venture:

Belgium. Socite de Bruxelles pour la Finance de l'Industrie 'Brufina', Brussels; Comp. Reunie d'Electricite et de Transports 'Electrorail', Brussels; Societe Generale de Belgique, Brussels.

Denmark. Brumeister and Wain's Maskin-og Skibsbyggeri, Copenhagen; A/S Christiani and Nielsen, Copenhagen; A/S den Danske Landmandsbank, Copenhagen; The East Asiatic Company Ltd., Copenhagen; A/S Kampmann, Kierulff and Saxild, Copenhagen; A/S F. L. Smidth and Co., Copenhagen.

France. Banque de l'Indochine SA, Paris; France-Technique, Paris; Simca SA, Paris.

Germany. Allgemeine Elektrizitats-Gesellschaft AG, Frankfort; Braunschweigische Maschinenbauanstalt, Braunschweig; Commerzbank-Bankverein AG, Dusseldorf; Degussa, Frankfort; Demag AG, Duisburg; Deutsche Bank AG, Dusseldorf; Dresdner Bank AG, Dusseldorf; Felten u. Guillaume Carlswerk AG, Koln-Mulheim; Ferrostahl AG, Essen; Gute Hoffnungshutte, Oberhausen; Handels-Union AG, Dusseldorf; Hein, Lehmann u. Co. AG, Dusseldorf; Hochtief AG fur Hoch- und Tiefbauten, Essen; Philipp Holzmann AG, Frankfort; Kloeckner-Humboldth-Deutz AG, Koln-Deutz; Kloeckner u. Co., Duisburg; F. H. Kocks KG Ingenieure, Koblenz; Fried. Krupp, Essen; Lubecker Maschinenbau AG, Lubeck; Maschinenfabrik Buckau R. BWolf AG, Neuss; Orenstein u. Koppel AG, Dortmund; Phoenix Rheinrohr AG, Dusseldorf; Siemens-Schuckertwerke AG, Erlangen; Stahlunion Export GmbH, Dusseldorf; August Thyssen Huette AG, Duisburg-Hamborn; Friedrich Uhde GmbH, Dortmund; Wasag Chemie, Essen; Otto Wolff, Koln.

Italy. FIAT SpA, Turin; Innocenti SpA, Milan; Instituto Mobiliare Italiano, Rome; Italcementi SpA, Milan; Italconsult SpA, Rome; Montecatini SpA, Milan; Societa Adriatica di Electricita SpA, Venice.

The Netherlands. Albatros Superfosfaatfabrieken NV, Utrecht; Algemeene Kunstzijde Unie NV, Arnhem; van Doorne's Automobielfabriek NV, Eindhoven; Heineken's Bierbrouwerij Maatschappij NV, Amsterdam; Koninkl. Luchtvaart Maatschappij NV (KLM), The Hague; Koninklijke Nederlandsche Gist- en Spiritusfabrieken, Delft; Nederlandsche Handel-Maatschappij NV, Amsterdam; Philips' Gloeilampenfabrieken NV, Eindhoven; Rotterdamsche Bank NV, Rotterdam; R. S. Stokvis and Zonen NV, Rotterdam; Verenigde Aannermersbedrijven v/h Zwolsman, The Hague.

Norway. Christiania Bank og Kreditkasse, Oslo; Leif Hegh and Co., Oslo.

Sweden. Allmanna Svenska Aktiebolager (Asea), Vasteras; AB Astra, Apotekarnes Kemiska Fabriker, Sodertalje; Atlas Copco, Stockholm; AB Electro Invest, Stockholm; Telefon AB LM Ericsson, Stockholm; A. Johnson and Co., Stockholm; AB Scania-Vabis, Sodertalje; Skanska Cement AB Malmoe; Svenska Tandsticks AB, Jonkoping.

United Kingdom. Balfour Beatty and Co., London; The British Bank of the Middle East, London; The Chartered Bank, London; Dunlop Rubber Co. Ltd., London; Associated Electrical Industries (Overseas) Ltd., London; Imperial Chemical Industries, London; The Ottoman Bank, London; The Power-Gas Corporation Ltd., London; Schweppes Ltd., London; Taylor Woodrow Ltd., London; British-American Tobacco Co. Ltd., London.

United States. The First Boston Corporation, New York, NY; International Basic Economy Corporation, New York, NY; Kaiser Industries Corporation, Oakland, Cal.; Koppers Company Inc., Pittsburgh, Pa.; Rockefeller Center Inc., New York, NY.

'Chemistry in Changing World', Subject of RIC Presidential Address

FOR his presidential address to the Royal Institute of Chemistry on 18 April, Professor William Wardlaw chose as his subject matter 'Chemistry in a changing world'. After discoursing on chemists' salaries during the last 40 years and present day needs for scientists and technologists, Professor Wardlaw considered the problem of present day science teaching.

The last 15 years had witnessed a revolution in the physical sciences, noted the Professor. For the chemist the impact of nuclear fission had had scarcely less far-reaching implications than it had had for physicists and engineers. Attention which has been focussed on nuclear power, on rocket and jet propulsion and electronics had resulted in a marked increase in the amount of research in inorganic chemistry; for progress on many fronts in these new technologies was dependent on progress in this branch of chemistry.

Regarding the world position of British chemistry, the Professor said it could hold its head high. In the last two years the Nobel Prize had been granted to two British chemists.

There was an urgent and continuing need for well-trained chemists in the chemical industry. Professor Wardlaw considering the problem of existing shortages of scientific manpower felt it was essential that the universities and the colleges of technology should be set a target in order that present and future demands for scientists should be met. The Professor then referred to the recent enquiry by the Ministry of Labour into the numbers of scientists and of engineers now employed in Great Britain. The survey showed, Professor Wardlaw said, that the substantial number of chemists completing full-time courses in 1957 and 1958 would probably make the attainment of the target possible by the end of 1959.

Every year saw new applications of chemical science in the service of mankind and the opening up of new fields of activity for the professional chemist. It was clearly in the interest of all such chemists that they should co-operate in furthering the welfare of their profession and that there should exist a representative body to which government departments, the community and the members themselves should be able to turn for advice and assistance. The Royal Institute of Chemistry over the years had advanced in prestige and usefulness and stood high among the professional bodies of the Commonwealth and in the esteem of all who were able to appreciate the services it renders.

AEA Trend to Single-Purpose Instruments for Analysis

A SYMPOSIUM on instrumentation in chemical analysis was held recently at the Capenhurst works of the UK Atomic Energy Authority. Organised by the AEA Industrial Group to discuss the present state of instrumentation in the authority's laboratories and to further its advance, the symposium was attended by more than 100 senior members from the AEA staff of all groups. The symposium was opened by Mr. K. B. Ross, director of operations, Industrial Group.

The heavy analytical commitments of the AEA in operating intricate and sometimes hazardous processes have always called for a high degree of instrumentation in the laboratory. The present trend, however, is to reduce cost and expedite analysis by the production of relatively simple, single-purpose instruments and eventually to transfer these instruments to the operating plant as in-line analysers. The afternoon session was devoted to a discussion of the latter phase.

Proceedings of the symposium will not be generally available as some of the papers contained material still regarded as secret. However it is intended that as much of the material as possible will eventually be released.

Papers were as follows:

Session I: Instrumentation in the Laboratory

Chairman: Dr. D. T. Lewis, senior superintendent, Chemical Division, Atomic Weapons Research Establishment.

'Determination of trace components in gases', A. B. Davies and J. M Donaldson, AWRE. Many techniques for the continuous instrumental determination of trace impurities (<100 p.p.m.) in gas streams are in use at AWRE. The emphasis is on relatively cheap and robust instruments and galvanic, emissive and sonic techniques are the most favoured.

'Analysis of substantially pure uranium or plutonium solution in static or flowing systems by gamma absorptiometry', A. Whittaker, Windscale Works. The gamma absorptiometer has many attractive qualities, among them robustness, stability, and freedom from contact with the solution under analysis.

'Applications of gamma spectrometry', E. N. Jenkins, AERE, Harwell. The gamma spectrometer is an instrument of great analytical potential being capable of analysing complex samples with a minimum of chemical treatment.

'X-ray fluorescence spectrometry', H. M. Davies, AERE, Woolwich. This technique promises to be of great value. At present theory, instrumentation, and application are being studied.

'Direct-reading emission-spectroscopic determination of isotope abundance in uranium', R. P. Thorne, Capenhurst Works. A simple, inexpensive, direct-reading spectrograph has been developed which has sufficient resolution to enable the isotopic abundance of samples of enriched uranium to be determined by the use of the isotopic lines at 4244 A.

Session II: Instrumentation for Analysis on the Plant

Chairman: Mr. F. I. Hurley, head of the research and development laboratories, Capenhurst Works.

'Some radioactive techniques applied to plant process instrumentation', H. Bisby, AERE, Harwell. Many radioactive process streams may be monitored by means of their own emission. There are difficulties associated with this, but the technique of designing successful alpha, beta, gamma and neutron monitors has been mastered.

'Some instrument developments', E. Duncombe, J. Bishop, A. N. Hamer, C. D. Reid, Capenhurst Works. Mass-spectrometers capable of analysing solid samples and reactive fluoride gases, sonic monitors for gas streams, and simple infra-red absorptiometers for gas streams based on the use of narrow band pass interference filters were among the developments described.

'Automatic techniques for sampling radioactive liquors, R. W. Dickinson, F. Jones, Windscale Works. Special techniques have been devised for withdrawing automatically, samples ranging from small spot samples of high precision to integrated samples representing 24 hours' production.

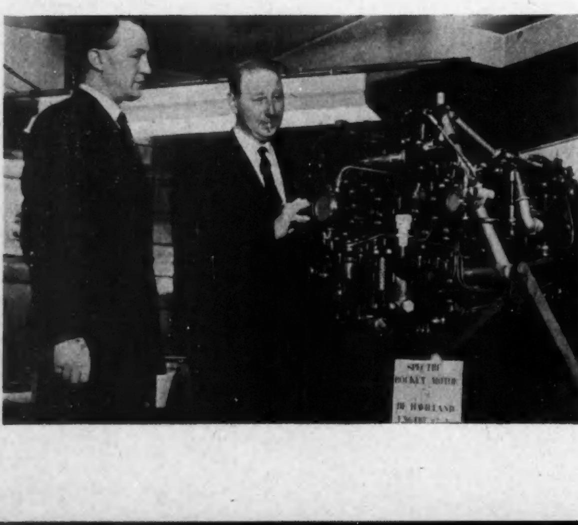
'Continuous monitoring of effluent solutions,' H. Mason, T. Mason, J. R. Sanderson, Springfields Works. An automatic absorptiometer for the determination of traces of uranium in effluent has been produced and experience obtained in its operation.

'Analysis of volatile inorganic halides by gas chromatography,' G. Iveson, Capenhurst Works. Specially developed gas chromatographic equipment is capable of giving in-line analyses of process streams containing volatile inorganic halides.

Croda Announce Formation of Belgian Subsidiary

Formation of Croda Belge, with headquarters at Verviers, Belgium, is announced by Croda Ltd., Snaith, Goole, Yorks. President of the new company is Mr. F. A. S. Wood, managing director of the Croda organisation. The managing director is Mr. Werner Daveloose.

'The objective of our new company is to increase Croda's export business and serve the northern part of the European market', said Mr. Wood in a company announcement. The company will manufacture lanolin for the cosmetic and pharmaceutical industries and use it to make the same anti-corrosive compounds as in the UK. There are no existing lanolin manufacturers in Belgium.



Laporte Exhibition

J. Hamilton, sales representative, Laporte Chemicals, and G. E. Brook, a director of A. W. Brook, a Laporte subsidiary, seen at the exhibition held in Manchester recently by Laporte. They are looking at a rocket motor which uses high test peroxide

Leda to Market New Cancer Treatment in UK

THE Hungarian State Pharmaceutical Consortium have nominated Leda Chemicals Ltd. (pharmaceutical division), a subsidiary of F. W. Berk and Co. Ltd., as sole distributors in the UK and most Commonwealth countries for their new anti-neoplastic drug Degranol, known formerly to research workers in the chemotherapy of cancer as BCM. This product was first prepared by Dr. L. Vargha of Hungary by linking nitrogen mustard with mannitol to form 1.6-bis-(betachloroethylamino)-1.6-desoxy-D-mannitol-dihydrochloride.

Extensive clinical trials in Hungary have shown Degranol to be a powerful yet virtually non-toxic prohibitor of neoplastic growths. Particularly favourable results have been obtained in the treatment of malignant diseases of haemopoietic and lymphatic systems. Subsequent follow-up has corroborated these results and large-scale controlled clinical trials are now being carried out in this country.

New UK Heat-Resistant Plastics Material

A NEW heat-resistant plastics material has been developed by Lucent Products, Oaklands, Clayton Road, Chessington, Surrey. Known as Lucentine, it is a cast-styrene-divinyl benzene copolymer, having a softening point in the range of 130° to 140° C. It is claimed that it can be twisted and shaped easily at temperatures of between 150° and 200° C and yet will retain its shape when it is cooled. The material is also stated to have excellent machining properties, good electrical properties and good resistance to attack from chemical solvents including a number of solvents which would completely disintegrate normal polystyrene. Moreover, the company say that it will not develop machined faults when inserted into oils or petrol.

Lucentine is being made available in the form of rods, having a diameter of between ½ inch and 3 inches, and from 9 inches to 15 inches long. Longer rods of up to four feet in length could be manufactured.

Bradford Dyers New Laboratory

The Bradford Dyers Association have opened a new central laboratory. It will house the central research staff as well as the research staff of the three associated companies. Mr. James Ewing, presenting his annual address said that following the success of minimum iron finish for drip-dry shirts, introduced last year, another finish, 'Regmel C-CL' has been developed, which withstands bleach chlorine to a high degree.

Lime Works Gutted

The Arden Lime Works, Glasgow, owned by Allan Kirkwood and Co. Ltd. were destroyed by fire recently. It is believed that the fire may have been started maliciously. 24 hours before the outbreak a bottle of paraffin had been found on the floor of the building, and three months ago an attempt had been made to start a fire in the same building with a bundle of stolen firelighters.

Overseas News

BIG INCREASE IN SYNTHETIC RUBBER OUTPUT PLANNED BY BAYER

BAYER of West Germany plan to increase production of their Perbunan N synthetic rubber, which has special heat and oil resisting qualities, from about 6,000 tons a year to between 12,000 and 15,000 tons. So far production has been restricted owing to lack of adequate butadiene supplies in West Germany. Now larger quantities of this material will be available after the Bunawerke Hüls synthetic rubber plant starts producing this summer.

Bayer also intend to expand production of Perbunan G (neoprene) synthetic rubber, a chlorine butadiene polymerisation product, to between 12,000 and 15,000 tons a year. This type of synthetic rubber is produced under licence from Du Pont.

Professor U. Haberland, Bayer's managing director, says that production of synthetic rubber was largely being expanded to increase exports, chiefly to other members of the European common market. He has also stated that the company will start producing Polykarbonat, a new type of plastics, this year at an initial rate of 100 to 150 tons a month. Polykarbonat, which would be produced in the Bayer plant at Uerdingen, is suitable as an insulating material for the electrical industry.

The company's total sales rose to DM.1,853,100,000 (£159 million) in 1957, about 16 per cent more than in the previous year. Exports rose by 1 per cent to 41 per cent of total sales. Professor Haberland said prospects for the development of production and sales this year were favourable though the rate of increase was expected to be smaller than in 1957.

Nitrogen Position Causes Setback in Italian Chemical Industry

One of the salient facts that emerged during the 'Chemistry Days' held recently in Milan on the occasion of the local International Fair is that the aggregate output of Italian chemical industry in 1957 was 4 per cent up on 1956. As the industry of the country, taken as a whole, experienced an increase of 7.8 per cent, this is taken as a sign that the post-war expansion of Italian chemical industry is now experiencing a check.

Many in the industry say that this is due to an inadequate consumption of nitrogen. Annual capacity of Italian plants engaged in the production of fixed nitrogen totals about 500,000 tons. Combined industrial and agricultural consumption accounts for only about 300,000 tons while exports in 1957 totalled 115,000 tons. This means that nitrogen plants worked to 83 per cent of rated capacity. When new factories scheduled for this year start operating, the total potential will go up to about 600,000 tons reducing utilisation of the plants to some 69 per cent.

Principal customers of the Italian chemical industry are the textile and allied industries. These absorb the following percentages of the total Italian output of chemical products:

	per cent
Textile industry proper	about 20
Artificial and synthetic fibres	about 12
Clothing industry	about 8
Total	about 40

As the per-capita consumption of textile products in Italy is one of the lowest in Europe, many experts forecast that it is bound to rise sooner or later.

German Company to Construct Potash Plant in Jordan

An offer by the West German company, Chemibau, to construct an experimental potash plant in Jordan for the Arab Potash Co. within the next six months, has been approved in principle by the company. It is understood that certain conditions contained in the German offer have been modified by the company.

The Jordan Economic Minister, who has left for West Germany accompanied by a director of Arab Potash Co., has been authorised by the company to discuss this plant with Chemibau.

If negotiations with the German company prove successful, the cost to Jordan to carry out the major potash project would be reduced from £4½ million to £1 million.

Sulphuric Acid Plant for Rumania

A new sulphuric acid plant has been in operation in Rumania since last year in the Copsa Mica region. The plant, which is the largest in Rumania, has a production capacity of 30,000 tons a year.

Plant and special installations were obtained mainly from Eastern Germany. In 1955 Rumania produced 92,000 tons of sulphuric acid. Estimated production for 1957 is put at 130,000 tons. In 1960, this production will be of the order of 210,000 tons.

New Polyvinyl Acetate Plant for Celanese Corporation

Construction has been completed of a new manufacturing unit to produce polyvinyl emulsions at the Belvidere, New Jersey, US, plant of Celanese Corporation of America. Annual capacity of the installation is reported to be over 20 million lb. The Celanese plant in Linden, New Jersey, formerly produced polyvinyl acetate emulsions. Facilities at this plant will now be employed exclusively for the manufacture of polyester resins. At the Belvidere plant are produced cellulose acetate, and cellulose propionate moulding powders, cellulose acetate extruded and cast film, and tri-acetate photographic film base.

US Company Producing 'White Carbon Black'

'White carbon black', described as an extremely fine, pure form of silica (15–20 millimicrons: 99 per cent-plus silicon dioxide) is now being produced by Godfrey L. Cabot, Inc., Tuscola, Illinois. This company is using the Degussa process (Degussa AG, Frankfurt, Germany) who have exported their product Cab-O-Sil to the US since 1953. At present the primary intermediate silicon tetrachloride is being bought by Cabot but plant to produce this silicon compound is expected to be ready shortly. Design capacity of the 'white carbon black' plant is 5.6 million lb. a year of silica, which can be doubled if required.

Aid for Sicilian Sulphur Mines Approved

Text of a Bill to end the crisis in the Sicilian sulphur mines has been approved by the Sicilian Regional Government. The Bill proposes the establishment of a credit fund of six milliard lire with the Bank of Sicily to help the sulphur mining companies to modernise and reorganise the mines and reduce their overheads. Provision is also proposed for the creation of a Regional Solidarity Fund for the mining industry, the granting of facilities to sulphur mining companies to increase the productivity of the mines by producing sulphuric acid from the mineral sulphur and assistance to the mining companies in their attempts to reduce overheads.

New Catalyst for Low Pressure Polyethylene

Bakelite Company Division of Union Carbide Corporation report a new catalyst system for ethylene polymerisation. Tetraphenyl tin and aluminium bromide was found to form an efficient catalyst for low-pressure ethylene polymerisation. Vanadium compounds are stated to be an essential ingredient of the catalyst.

Rumania's New Synthetic Rubber Plant

Plants to be built for the Rumanian oil industry include a unit for the conversion of propylene and butadiene into alcohols, acetone and methyl-ethyl-ketone. The first Rumanian synthetic rubber plant with a 25,000-tons-a-year capacity will be commissioned before the end of the present five-year plan (1955-1960).

Rumanian crude oil contains a considerable amount of naphthenes. The separation of the cyclohexane and the methyl cyclopentane isomers will be carried out on a large scale to produce the auxiliaries necessary for the manufacture of polyamide plastics of the Capron and nylon types. Refineries will also

produce fatty acids and alcohols, aromatic hydrocarbons, detergents and a wide range of other raw materials for the country's chemical industry

Modern processing methods now being studied in the oil and petrochemical research institutes will soon be applied. It is stated that the Rumanian petrochemical developments will meet the needs of the home market, and will leave a margin for export.

West German Firm Seeks UK Chemicals

Chemimpex, G.m.b.H., 53a Bockenheimerlandstrasse, Frankfurt/Main, wish to contact UK manufacturers of chemicals, both industrial and pharmaceutical, but principally the former.

GP-121 New Parke-Davis Anaesthetic Preparation

From Parke-Davis and Co., Detroit, Michigan, US, comes news of a new type of rapid-acting anaesthetic, known as GP-121. The compound is described as a form of phenyleylohexyl piperidine monochloride and can be injected. Some 70 patients at the Detroit Receiving Hospital have received the new drug. According to the manufacturers this anaesthetic will open up new avenues in the use of drugs other than barbiturates as anaesthetics. It is claimed that it can be used either for superficial surgery or in continuation with other drugs for major surgery.

Production of Monochlorobenzol in Italy

According to the data compiled by *Aschimici*, the following Italian firms are engaged in the production of monochlorobenzol: ACNA (Milan), Rumianca (Turin), Saronia (Melegnano, near Milan), and Bergamasca Industria Chimica (Seriate, near Bergamo). Their aggregate output totals from 3,000 to 3,500 metric tons a year.

About 60 per cent of the 4,500 tons of monochlorobenzol now consumed in the country are utilised for the production of anticryptogammics and the rest for dyestuffs.

Italy's foreign trade in this product is as follows:

	1951	1952	1953	1954	1955	1956	1957
Imports (tons)	88.8	7.9	16.2	1.3	58.6	201	1,459.3
Exports (tons)	20.0	30.0	1.9	—	40.6	106	49.6

Chilean Nitrate Sales

It is expected that sales of nitrate in Chile will improve during 1958. Output of the Anglo-Lautaro Co. is expected to reach 1.3 million tons.

Finnish Sulphuric Acid Production

Production of sulphuric acid rose in 1957 to 163,000 tons, a 6.5 per cent increase on the total for the previous year. According to information furnished by the director general of nitrogen factories and of superphosphate administration for the State, the quantity of sulphuric acid used by industry increased by 17 per cent, a rise for 1957 of 51,140 tons.

Chemical fertiliser sales from these plants have reached 654,000 tons, a 26,000-ton fall compared with sales in 1956. The fertiliser sales were made up as follows: superphosphates, 115,000 tons (138,000 tons in 1956); phosphate Kotka 241,600 tons (192,100); fertiliser X, 287,600 tons (224,000); sulphate of ammonia, 743 tons (3,200) and phosphate (alimentary) 8,600 tons (10,400).

Rabbit Killing Chemical

Sodium fluoracetate used as a rabbit poison is having a 'dramatic success' in Australia, reports the Commonwealth Scientific and Industrial Research Organisation. Kills of more than 90 per cent have been observed, and it is calculated that rabbits are being exterminated at a rate not far below the myxomatosis virus disease when it was most virulent.

Israel and Peru Approach Japan for Technical Help

In response to requests from Israel and Peru, a Japanese fertiliser plant mission now touring Brazil is to return to Tokyo via the two countries.

The Japanese Fertiliser Plant Association reports that Israel have sent a proposition to the association regarding the construction of a urea and ammonium sulphate factory in Israel. The Guano Development Public Corporation of Peru have asked the association for technical assistance.

Belgian Work on Separation of Niobium-Tantalum

Separation of niobium-tantalum starting from a mixture of relatively pure oxides, has been realised chromatographically on ion-exchange columns in Belgium (*Belge Chem. Ind.*, 1958, I. xxii, No. 2, 123). Dowex 2 was used as adsorbant and substratum for the downward flowing elution. Maize starch formed the base and was the regulator of the flow of eluted ions in the lower section of the columns.

The eluted fractions have been characterised by means of precipitation and coloration reactions with hydrazine hydrate and pyragallol.

Slow elution was continued day and night by feeding the eluent from constant level flasks and by means of the interaction of the starch as flow moderator.

Separation into pure niobic and tantalic acids, which were changed into oxides by evaporation and calcination, was possible. No radioactive indicator was required and there was no hydrofluoric acid used or special columns used.

New Pharmaceutical Facilities for Columbia

Among new pharmaceutical facilities opened in Colombia are those of the Italian firm Carlos Herba and the German concern, Hoescht.

W. German Chemical Industry Favours Free Trade

West German chemical industry is emphatically in favour of a Free Trade Area, stated Herr Balke, Atomics Minister, at a dinner given by the German Association of Chemical Industries at the Hanover Fair on Tuesday.

Herr Balke considered that the problem of certificates of origin could be solved, as far as the chemical industries were concerned. To be on an equal footing with the US industry, however, where costs of primary materials were substantially lower, granting of certificates of origin should be governed by either one of the following principles: (1) instead of the value added in the last phase of chemical processing, the value added in the last but one phase should be decisive; or (2) the added value in the last phase of manufacture should be the equivalent of at least 50 per cent of the value of the primary product. Otherwise, said the Minister, cheap sources of primary materials would enable US makers of, for example, caprolactam to swamp European markets.

Cross-Linked Polythene-Carbon Black Withstands Oven Heat

RESEARCH resources of Hercules Powder Inc. and Godfrey L. Cabot Inc., have been pooled and the companies have arranged for a complete exchange of information for their work on cross-linked carbon black and polythene. Cabot's work was announced earlier. Hercules, however, recently received a patent, US 2,826,570, on cross-linked polythene.

Details available to date show that one part each of polythene and carbon black with a small quantity of dicumyl peroxide as cross linking agent are given gentle milling to ensure a homogeneous mix. The compound formed (Cab-XL) is extruded by wire and cable manufacturers in existing equipment. The wire is then treated with steam under pressure in a conventional continuous vulcanisation to decompose the peroxide and cross-link the material.

As much as 400 parts of black can be added to 100 parts of polythene resulting in a useful end product. As the cross-linking is carried out chemically there is no limitation of shape or thickness of the finished product.

The new compound is stated to have excellent electrical insulating properties. Specific compounds can be produced with high conductivity making them useful as semi-conducting coatings by cable makers.

A marked superiority in heat resistance and toughness has been demonstrated for this polythene compound. Because of its low cost and strength, Hercules and Cabot believe that the material may prove useful for making building panels, roofing materials and conduits. The possibility of moulded articles is being examined as it is considered that the new product might compete with other thermosetting materials.

FLUORINE CHEMISTRY DEVELOPMENTS—3

Nonafluorocyclohexanes and Derived Compounds, by Dr. J. C. Tatlow

A PAPER presented by Dr. J. C. Tatlow, Birmingham, University at the symposium on fluorines* dealt with 'Nonafluorocyclohexanes and derived compounds'.

It was recalled by Dr. Tatlow that fluorination of benzene had been carried out(1)(2) in the vapour phase with cobaltic fluoride at temperatures of 130–200°C. These conditions were much milder than those used(3) for the synthesis of saturated fluorocarbons from aromatic compounds, i.e. of perfluoro*cyclo*hexane (C_6F_{12}) from benzene. The product(2)(4)(5) was a complex mixture of hydrogen containing polyfluoro*cyclo*hexanes boiling between 50° and 150°C, many members of which were low-melting solids. These did not depress each other's melting points since the mixture itself was also solid. For the separation of it, and for investigations on the components, gas chromatography has been applied(6), not only as an analytical technique, but also as a preparative-scale process, large columns having been developed(6)(7) capable of separating up to 20 g. of volatile mixtures with a very high degree of efficiency, much greater than that of distillation.

Fractional Distillation

Many of the fluoro*cyclo*hexanes were obtained pure by careful fractional distillation controlled by analytical gas chromatography, which considerably enhanced the value of the distillation technique. However, for the isolation of some components, preparative-scale gas chromatographic separation of mixed fractions was necessary.

The most important method used for the establishment of the structures was dehydrofluorination with concentrated aqueous potassium hydroxide. After determination of the number of unsaturated products by analytical gas chromatography, they were isolated pure by preparative-scale gas chromatography (because of the similarity of physical properties this was usually impossible in other ways). They were then identified by elemental analysis, oxidation, spectroscopy(8)(9), etc.

Undecafluoro*cyclo*hexane (C_6HF_{11}) underwent(1) reaction to give 1H:2H-decafluorides [b.p. 70°C (I) and 91°C (II)] whose structures were established as follows(2): Isomer (I) underwent dehydrofluorination with difficulty, giving three products and much starting material; Isomer (II) gave, quite readily, only one product. These were identified by oxidation(2).

Much was now known about the preferred conformations of the rings in *cyclo*hexane compounds. This indicated that fluoro-derivatives should be in the chair form and the small hydrogen atoms where possible should occupy *axial* positions. Thus, one of the 1*H*:2*H*-isomers should have two *axial* hydrogens and one have an *axial* and an *equatorial* hydrogen. Therefore, the latter, the *cis*-form, will have two >CHF groups with an axial hydrogen and an axial fluorine on adjacent carbons, all four centres coplanar. This arrangement was the best for easy elimination both on electronic and stereochemical grounds(2) and should therefore be the structure of the isomer (II). The *diaxial* or *trans* arrangement of hydrogen should give much less ready elimination, as was found with the isomer (I). These allocations of structure were confirmed(2) by dipole moment measurements. The structures of the other four decafluoro*cyclo*hexanes were established(4) in similar ways.

The first two nonafluoro*cyclo*hexanes obtained(5) had b.p. 92°C (III) and 101°C (IV). Each gave the same six unsaturated products (A, B, C, D, E, F) upon dehydrofluorination.

Difluoromalonic Acid

A had formula C_6HF_7, was oxidised to give difluoromalonic acid (2 mol.), and had infra red(8)(9) and ultra violet absorptions characteristic of a 1:4-diene system. B and C had formulae C_6HF_7. Each was oxidised to tetrafluorosuccinic acid (1 mol.) and had infra red(8)(9) and ultra violet absorptions characteristic of a 1:3-diene system. (Not distinguishable by this means but identified later.) D was hexafluorobenzene. E was $C_6H_2F_8$ and was oxidised to a hexafluoroadipic acid of structure $HO_2C.CHF.CHF.CF_2.CF_2.CO_2H$ since it was degraded (alkaline $KMnO_4$) to tetrafluorosuccinic acid. Upon dehydrofluorination E gave a mixture of the dienes B and C (1:2-elimination) and hexafluorobenzene (1:4 elimination). F had formula $C_6H_2F_8$ and was oxidised to a different hexafluoroadipic acid of structure $HO_2C.CF_2.CHF.CHF.CF_2.CO_2H$ since it was degraded by alkaline $KMnO_4$ to give difluoromalonic acid (2 mol.). Upon dehydrofluorination F gave the diene A and hexafluorobenzene.

Clearly therefore the nonafluoro*cyclo*hexanes III and IV had 1*H*:2*H*:4*H*-structures. The only mono-olefinic products found arose from eliminations at the isolated hydrogen, suggesting that the 1*H*:2*H*-system had the *trans*-arrangement, i.e. the more stable one. Qualitative comparisons of the rates of formation of the mono-enes (E and F) indicated that compound III (b.p. 92°) was the 1*H*a:4*H*e/2*H*a:4*H*a-isomer, and compound (N) (b.p. 101°) the 1*H*a/2*H*a:4*H*a-isomer. This was proved in two ways. Firstly the 1*H*a/2-*H*a (*trans*) system should give rise to racemic i.e. resolvable derivatives, and the hexafluoroadipic acid derived from compound F was resolved *via* its brucine salt. Secondly, further fluorination of the nonafluorides using cobaltic fluoride gave(4), besides C_6F_{12} and C_6HF_{11}, from compound III the known decafluorides 1*H*/2*H*, (b.p. 70°), 1*H*:4*H*/– (b.p. 86°) and 1*H*/3*H*– (b.p. 78°) and from compound IV the 1*H*/2*H*–, (b.p. 70°), the 1*H*/4*H*–, (b.p. 78°) and the 1*H*:3*H*–, (b.p. 89°). The structures of III and IV were confirmed also by infra red studies(8).

The third nonafluoro*cyclo*hexane(V), (10) (b.p. 107°), was dehydrofluorinated to give six products. Of these, the three dienes (A, B, C) were the same as before. Two mono-olefins (E_1, F_1) were obtained, stereoisomeric with E and with F, differing only in the arrangement of the hydrogens i.e. *cis* instead of *trans*. The derived hexafluoroadipic acid from compound F_1 was not resolvable *via* its brucine salt. The sixth product (G) was a mono-olefin, giving 3*H*-heptafluoroadipic acid upon oxidation, and converted by fluorination (CoF_3) to 1*H*/3*H*– (b.p. 78°) and 1*H*:3*H*/–decafluoro*cyclo*hexane (b.p. 89°).

Dehydrofluorination with alkali gave the di-olefins A and C, proving that C must be 2*H*-heptafluoro*cyclo*hexa-1:3-diene. It is of interest that by fluorination of benzene with manganese trifluoride the isomeric compound, G_1, was obtained(11): this was proved(10) by further fluorination to give 1*H*/4*H*– (b.p. 78°) and 1*H*:4*H*/–decafluoro*cyclo*hexane (b.p. 86°).

Dehydrofluorination

Dehydrofluorination with alkali(10) afforded the di-olefins (A) and (B), showing that (B) was 1*H*-heptafluoro*cyclo*hexa-1:3-diene.

Further fluorination of V gave the decafluoro*cyclo*hexanes 1*H*:2*H*/– (b p 91°), 1*H*/4*H*– (b p 78°) and 1*H*/3*H*– (b.p. 78°). Thus, V was 1*H*a: 2*H*e/4*H*a-nonafluoro-*cyclo*hexane.

The fourth stereoisomeric nonafluoride (VI) the 1*H*e:2*H*a:4*H*a/-compound was a minor constituent with b.p. 124°. Fluorination gave the 1*H*:2*H*/– the 1*H*:3*H*/– and the 1*H*:4*H*/-decafluorides and dehydrofluorination seven products (A, B, C, E_1, F_1, G, G_1).

The four nonafluorides (III, IV, V, VI) were all synthesised.

* *Other papers presented at the symposium on 'Some recent developments in the chemistry of fluorines', were summarised in Chemical Age, 19 April, p. 727 and 26 April, p. 769.*

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Fluoro-Derivatives of Aromatic Hydrocarbons

FLUORO-DERIVATIVES of aromatic hydrocarbons have been known for some considerable time. These were now being readily prepared by the Balzschiemann method which involves the thermal decomposition of the solid diazonium fluoroborates:

$$ArN_2Cl \xrightarrow{NaBF_4} ArN_2BF_4 \xrightarrow{heat} ArF + N_2 + BF_3$$

Discussing 'Fluoroaromatics from polyfluoro*cyclo*hexanes' Dr. R. Stephens, University of Birmingham, said that using the Balzchiemann method in this way di-, tri- and tetrafluorobenzenes had been prepared (Finger *et al.*), *viz.*, *o*, *m* and *p* —$C_6H_4F_2$, 1:2:4 and 1:3:5— $C_6H_3F_3$ and 1:2:4:5— and 1:2:3:5— $C_6H_2F_4$. The extension of the method to the pentafluorobenzene broke down owing to the oxidation of the tetrafluorobenzene to a difluorobenzoquinone by the nitration mixture.

An alternative approach to highly fluorinated aromatics was followed by McBee who prepared a small amount of hexafluorobenzene by the reaction of hexachlorobenzene with BrF_3 and subsequently SbF_5, followed by dechlorination with zinc dust.

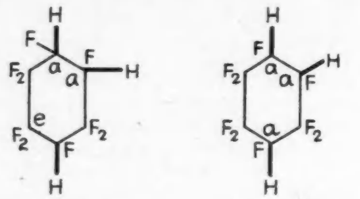
A novel method for hexafluorobenzene preparation was discovered by Desirant and reported in 1955; this involved the pyrolysis of tribromofluoromethane (prepared from tetrabromomethane and SbF_3):

$$6\ CFBr_3 \xrightarrow[630\text{–}640\,^\circ C]{\Delta} C_6F_6 + 9Br_2$$

This reaction has since been the object of a detailed study into methods of improving the yield of Hellmann *et al.* These authors found that at pressures of 4.5 atmos. of N_2 in platinum tubes an optimum yield of 55 per cent was achieved at 540–550°C (on consumed $CFBr_3$).

Although the first published work on fluoroaromatics from the Birmingham school concerned hexafluorobenzene and appeared in *Nature*, 1956, **178**, 199, the first fluoroaromatic to be prepared in these laboratories was a tetrafluorohydroquinone obtained by reducing the quinone $C_6F_4O_2$ prepared from the oxidation of an octafluoro*cyclo*hexa-1:4-diene, C_6F_8, which is formed on dehydrofluorination of certain decafluoro*cyclo*hexanes, $C_6F_{10}H_2$ with aqueous potassium hydroxide, i.e. from the sequence of reactions: (see below)

Use made of a similar dehydrofluorination procedure to certain nonafluoro*cyclo*hexanes ($C_6F_9H_3$) boiling at 93° and 101°, and having conformations represented by:



b.p. 93°C. b.p. 101°C.

yielded hexafluorobenzene together with five other olefins in about 15–16 per cent of that theoretically possible with exclusive +ve-elimination. The separation of the six-component system was facilitated by the application of gas-liquid partition chromatography on a preparative scale. (1)

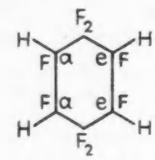
This dehydrofluorination method was then logically extended to the preparation of the pentafluorobenzene which was hitherto unknown. Thus fractions were obtained in the distillation of the polyfluoro*cyclo*hexane mixture boiling at 118°, 125°, 133° and 136° and were analysed for octafluoro*cyclo*hexanes, $C_6F_8H_4$ On dehydrofluorination with aqueous potassium hydroxide all gave pentafluorobenzene together with three other olefins in varying yields. The separation of the mixture was again facilitated by preparative scale gas-liquid partition chromatography.

The structures of the octafluoro*cyclo*hexanes were elucidated by fluorination with cobalt trifluoride in a small static copper reactor and identification of the nonafluoro*cyclo*hexanes* formed. In this way all four were shown to be 1*H*:2*H*:4*H*:5*H*-octafluoro*cyclo*hexanes since only the known 1*H*:2*H*:4*H*-nonafluoro*cyclo*hexanes were obtained.

The results obtained were:

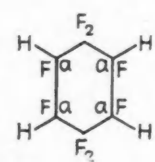
(a) The $C_6F_8H_4$ (b.p. 118°) gave only the $C_6F_9H_3$ (b.p. 93°), i.e. the 1*Ha*:4*He*—$C_6F_9H_3$ and the decafluoro*cyclo*hexanes derived therefrom.

Therefore the original $C_6F_8H_4$ is 1*Ha*:2*Ha*:4*He*:5*He*.



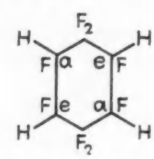
(b) The $C_6F_8H_4$ (b.p. 125°) gave only the $C_6F_9H_3$ (b.p. 101°), i.e. the 1*Ha*:2*Ha*:4*Ha*—$C_6F_9H_3$, etc.

Therefore the original $C_6F_8H_4$ is 1*Ha*:2*Ha*:4*Ha*:5*Ha*.



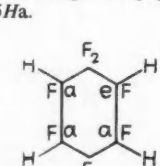
(c) The $C_6F_8H_4$ (b.p. 133°) gave only the $C_6F_9H_3$ (b.p. 107°), i.e. the 1*Ha*:2*He*:4*Ha*, etc.

Therefore the original $C_6F_8H_4$ is 1*Ha*:2*He*:4*Ha*:5*He*.



(d) The $C_6F_8H_4$ (b.p. 136°) gave all the nonafluoro*cyclo*hexanes (b.p.'s 93, 101, 107, 124°C) and the six decafluoro*cyclo*hexanes derived therefrom.

Therefore the original $C_6F_8H_4$ is 1*Ha*:2*Ha*:4*He*:5*Ha*.

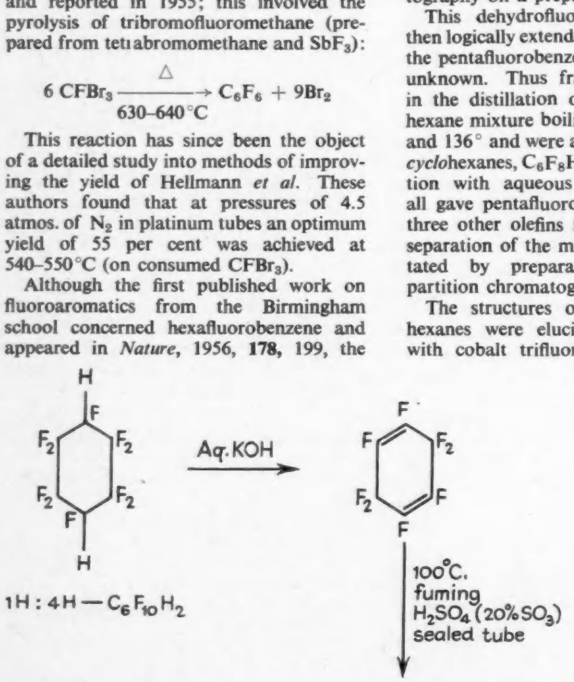


Considering the dehydrofluorination again, the following products were obtained: (See next page).

The yield of pentafluorobenzene varies with the structure of the tetrahydro octafluoro*cyclo*hexane. The best yield is given by the isomer (b.p. 118°), *viz.*, 55 per cent of theoretical tri-elimination.

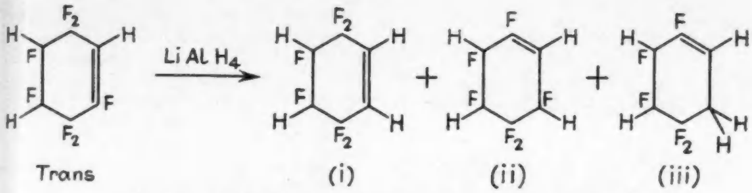
At this stage in the work a route to the tetrafluorobenzenes was realised by the action of lithium aluminium hydride in ether at about 45°C on the trihydro-monoene (IV) (*trans*isomer): (See top of next page).

Compound (i) was also isolated from polyfluoro*cyclo*hexane mixture in small yield.

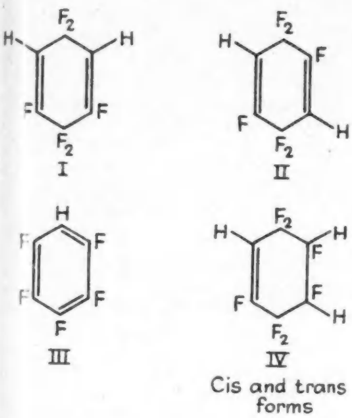


Sequence of reactions in defluorination

* *known structures*



Action of LiAlH on trihydro-monoene (IV) (see below)
Figure (iii) denotes possible structure



Products from Defluorination

Dehydrofluorination of these products with aqueous potassium hydroxide affords tetra- and trifluorobenzenes:

Of all the fluorobenzenes (12 in all) only the 1:2:3-trifluorobenzene remains unknown.

Work on the chemical properties of the penta- and hexafluorobenzenes is still in its early stages. However, several important reactions have been effected and the susceptibility to nucleophilic attack on nuclear fluorine demonstrated. More detailed study and extension of these reactions is now in progress. (2)

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Process to Produce Sugar from Wood

SIMPLIFICATION of the two-phase process for producing sugar from wood, developed originally by Professor Bergius, has been announced by Rheinauer Holzhydrolose GmbH and Chemische Holzverwerting GmbH, both of Mannheim-Rheinau.

By using sawdust instead of the more expensive shavings and saving two-thirds of the hydrochloric acid used in the Bergius process, the process becomes a cheap one-phase process. It is claimed also that 90 per cent of the wood substance is transformed into equal quantities of glucose, xylose, and lignine.

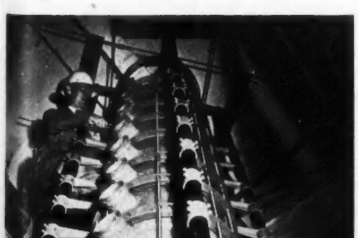
Xylite, a polyalcohol used as a food preservative, can be extracted from the mother-lye remaining after crystallisation of glucose and xylose. The mother-lye also yields raw materials for detergents, varnish and plastics.

The lignine produced condenses with phenol to produce a plastic similar to Bakelite, and which can be used also in paint manufacture and as a coating for sand casting. It can also be used in the rubber industry to make rubber goods light. One Rheinau plant produces 7,200 tons of lignine a year and towards the end of this year additional plant with a monthly output of 30 tons of polyalcohol will come into operation.

All-glass Distillation Column

AN all-glass bubble cap distillation column, 16 ft. tall, believed to be the largest of its kind, has been manufactured by Corning Glass Works, US. The column, weighing about 2,000 lb. and measuring 23½ in. in diameter, was designed and constructed for a chemical company for use in the manufacture of metallic silicon. Glass construction was specified to meet strict purity requirements.

Thirteen armoured Pyrex-brand cylindrical sections make up the column. Included are two end pieces and 11 pieces with 4 in. conical pipe flange connections.



The 16-ft. all-glass distillation column

The sections and plates were specially fabricated at Corning. Sections and plates are placed one on top of each other, with the unit being held together by tie rod construction. Teflon envelope-type gaskets are placed between the sections to effect the seal.

Between the armoured sections are 12 of Corning's Multiform bubble cap plates of Vycor brand glass, a 96 per cent pure silica glass. In the Multiform process, powdered glass is slip cast, then fused, to make possible formation of complex shapes. The plates in the column are some of the largest parts ever made by this process, weighing about 65 lb. each.

Previous glass columns of the same diameter have contained as many as six glass plates. With the added plates of the 16-ft. column there is increased assurance of product purity.

Surface Coating Resin Index

A revised edition of the Surface Coating Resin Index, first published in 1955 by The British Plastics Federation and the Surface Coating Synthetic Resin Manufacturers' Association is due in the autumn of 1958.

The booklet gives under one cover the basic information on British-made surface coating synthetic resins available to the paint, printing ink and allied trades. Contributions are not restricted to members of the two organisations and other British manufacturers who would like their products included, are invited to communicate with The British Plastics Federation, 47-48 Piccadilly, London W1.

Course on Rubber and Plastics Analysis

A TWO-WEEK residential course of lectures and practical work on chemical analysis of rubbers and plastics will be held at the National College of Rubber Technology, Holloway Road, London N7, from 7 to 18 July.

The following lectures will be held:

(1) Introduction: survey of the subject, (2) qualitative identification of elastomers, (3) qualitative identification of plastomers, (4) qualitative identification of fillers and pigments, (5) quantitative estimation of elastomers, (6) quantitative estimation of plastomers, (7) quantitative estimation of fillers and pigments, (8 and 9) identification and estimation of trace ingredients, (10 and 11) identification and estimation of plasticisers, softeners, extenders and like materials, (12) chemical analysis of latices, (13 and 14) principles and application of physical methods used in rubber and plastics analysis, (15 and 16) related topics: polymer degradation and chemical ageing tests.

Accommodation for the course is limited and early application should be made to the college. Fees are 22 guineas for UK students and 30 guineas for overseas students.

New Moulded Plastics Plant

A plant for British Moulded Plastics Ltd. has been opened in Swindon. In the 81,000 sq. ft. of production and storage space Styrex microporous battery separators will be made, as well as hard rubber, bituminous rubber and compression mouldings.

Analytical Review

TITRATION OF ACIDS IN NON-AQUEOUS SOLVENTS

RESOLUTION of mixtures of dibasic acids is most readily achieved when two sharp inflections are obtained in the titration curve for each acid. Many dibasic acids which give only one inflection when titrated in water, e.g. sulphuric acid, give two sharp inflections in non-aqueous solvents. The choice of solvent is a matter of great importance. Thus, attention must be given to its acidity, for example phenol cannot be titrated in water because of the acidity of the solvent molecules (whose concentration is approximately 55 N) but in ethylenediamine the titration proceeds smoothly. However, acids are levelled in a strongly basic solvent such as ethylenediamine so that generally all acids stronger than acetic acid show equal strength and differentiation is not possible. Thus the ideal solvent must be sufficiently basic to permit titration of the weakest component yet not so basic that the resolution of stronger components is inhibited. The dielectric constant of the medium also plays an important role. Most acids may be classed as (a) uncharged (benzoic acid, acetic acid), (b) positively charged (ammonium ion, anilinium ion), or (c) negatively charged (bisulphate ion, bioxalate ion). The relative strength of acids in any one group is scarcely affected by change of dielectric constant, but acids of differing charge vary greatly.

Harlow and Wyld (1) have made a study of the effect of varying the dielectric constant of the medium over the range 80 to 18 using tetra-n-butyl ammonium hydroxide as titrant for various dibasic acids. The solvent system used was water-*iso*-propanol since this dissolves most acids and permits a very wide variation in dielectric constant. The maximum resolution of the two protons in sulphuric acid, succinic acid and oxalic acid is achieved in anhydrous *iso*-propanol.

Decrease in Resolution

A considerable decrease in resolution occurs if even a few per cent of water is present, e.g., practically no resolution of the protons of sulphuric acid is possible when the *iso*-propanol content is less than 80 per cent. The effectiveness of *iso*-propanol is attributed to its low dielectric constant since the two acids involved, e.g. hydronium ion and bisulphate ion for sulphuric acid, are of different charge types. No increase of resolution was achieved for acids of the same charge type, e.g. bisulphate and bioxalate in aqueous solution containing large amounts of *iso*-propanol—indeed the separation was better in water alone.

According to theory relating to acetic acid, positively charged acids become stronger as the dielectric constant is reduced and negatively charged acids tend to become weaker; neutral acids show little change. Another example of an acid mixture which is more readily resolved in water than in *iso*-propanol is not surprisingly ammonium ion (+ ve) and acetic acid (neutral).

In pure solvents such as water, methanol, ethanol and *iso*-propanol, the resolution of dibasic acids is directly proportional to the reciprocal of the dielectric constant, but a plot of resolution against known dielectric constant for aqueous *iso*-propanol reveals that the resolution is less favourable and that the behaviour is non-linear. Similar non-linear behaviour has been reported for acids in acetone-water (2) and dioxan-water (3). Harlow and Wyld make the interesting suggestion that in the immediate vicinity of the ions, 'unmixing' of the solvent takes place with concentration of strongly polar water molecules around the ions, so that the *effective* dielectric constant for the ions is much higher than the macro value for the solvent as a whole.

This article by Dr. T. S. West features:

1. Developments in non-aqueous titrimetry relating to the resolution of dibasic acids and the acidity of solvents used in the formulation of basic titrants.

2. A new reagent for the absorptiometric determination of small amounts of nickel.

3. The complexometric determination of magnesium in titanium sponge.

In another recently published paper (4), the same authors report on the influence of the acidity of the titrant solvent on the potentiometric titration of very weak acids in acetone and pyridine. Under these conditions water and methanol are more acidic than ethanol which in turn is more acidic than *iso*-propanol. In these studies tetra-n-butyl ammonium hydroxide was used as titrant and naturally the *iso*-propanol-based titrant was preferred. Solvents less acid than *iso*-propanol could not be used with this titrant because they promoted instability of the solute. On account of the acidity of the solvent, it is important therefore to work with concentrated titrants wherever possible.

Dimethylglyoxime is undoubtedly the most used reagent for the determination of nickel. Small amounts can be determined absorptiometrically by bromination of the nickel precipitate to form the soluble red complex. Recently quinoxaline-2, 3-dithiol has been used for this analysis and first reports (5)(6) seem to indicate that it may have some advantages over the conventional DMG reagent.

Quinoxaline-2,3-dithiol forms a pink coloured nickel chelate in ammoniacal solution, the absorption of which is sufficiently intense to permit the detection of 0.03 p.p.m. of nickel. The reagent is stable for three days and the nickel chelate maintains unchanged absorbance in solution for several hours. An accuracy of within 1 per cent was obtained in the range 0.1 to 3 p.p.m. of Ni using a 1 cm. cell on a Beckman DU spectrophotometer.

Absorbance of the reagent blank and of the test solution increases with rise in the ammonia concentration, but the absorbance due to the nickel chelate itself is independent of ammonia concentration.

Over the range 1.7 to 8.3 M NH_3 it is only necessary to ensure that the concentration of ammonia in the test solution should not vary by more than 0.4 M from that in the reagent blank. At least a 10-fold excess of reagent appears to be necessary, but a 10 to 20-fold excess has no influence on the absorbance of the nickel chelate.

Blank Value

Because the reagent absorbs appreciably, it is essential to measure the *exact* amount used so that the blank value can be determined precisely. When the colour is first formed, the absorption of the blank and of the uncorrected colour of the test solutions decreases rapidly to a minimum and subsequently increases more slowly. To minimise errors due to the interval between measuring the absorbance of the reagent blank and the test solution these measurements should not be made till one half-hour has elapsed.

At the 1 p.p.m. level of nickel concentration, twenty-five-fold excesses of cobalt, copper, silver and manganese interfered seriously. Cobalt forms a complex absorbing at 475 mμ close to nickel 520 mμ; the curves overlap. Manganese precipitates with the reagent. Twenty other ions showed no interference. One of the most interesting features of the reagent is that it forms a green nickel precipitate in acid solution which can readily be extracted into organic solvents. The green colour is said to be sufficiently intense in the organic layer to permit colorimetric measurements. Reversion to an aqueous phase is achieved by shaking the organic extract with ammonia, when the typical pink-red colour reappears in the water layer. The authors point out that this possibility of transferring the nickel back and forth between organic and aqueous phases may enhance the specificity of the reagent and further work on the reagent is to be awaited.

Workers at the Titanium Metals Corporation (America) have applied EDTA to the determination of magnesium in titanium sponge, etc. (7). Direct titration was not possible since titanium reacts with EDTA in the alkaline region while the use of masking agents such as Tiron, fluoride, peroxide, citrate, etc., was not successful, and separation by means of ammonia/ammonium chloride was not sufficiently effective. However, the ammonium acetate procedure separated titanium, iron and other alloying elements except manganese from the magnesium and loss of the magnesium on the separated acetates was negligible. The small amounts of manganese remaining in the solution were rendered

(*Continued on page 846*)

UK Chemical Exports and Imports for Jan.-March

EXPORTS

		QUANTITY		VALUE	
EXPORTS		Jan.-Mar. 1957	Jan.-Mar. 1958	Jan.-Mar. 1957	Jan.-Mar. 1958
INORGANIC					
Acids	Cwt.	62,051	57,639	163,313	193,130
Copper sulphate	Tons	11,542	10,184	1,055,290	632,713
Sodium hydroxide	Cwt.	1,182,449	1,078,557	1,568,918	1,099,957
Sodium carbonate	,,	1,130,542	646,394	794,082	460,572
Aluminium oxide	Tons	9,953	9,078	327,929	303,397
Aluminium sulphate	,,	6,892	8,983	100,658	128,714
Other aluminium cpds.	,,	904	827	40,336	34,418
Ammonia	Cwt.	22,293	21,148	78,204	80,822
Ammonium cpds. (not fertilisers and bromide)	Tons	4,928	3,451	184,550	145,350
Arsenical compounds	,,	1,284	500	92,863	34,117
Bismuth compounds	Lb.	94,626	121,958	78,861	96,457
Bleaching powder (chloride of lime)	Cwt.	70,240	66,885	125,834	115,295
Hydrosulphite	,,	30,786	16,849	240,661	117,872
Other bleaching materials	,,	34,391	51,136	160,862	256,039
Calcium compounds	,,	86,346	98,142	179,329	184,978
Carbon blacks	,,	197,841	258,463	703,686	1,010,981
Cobalt compounds	,,	3,291	5,046	144,358	196,163
Iron oxides (chemically manufactured)	,,	23,572	15,369	70,702	48,915
Lead compounds	,,	9,513	19,172	62,307	93,432
Magnesium compounds (nes)	Tons	4,380	4,376	216,307	220,568
Nickel salts	Cwt.	22,483	17,979	240,603	193,414
Potassium compounds (not fertilisers and bromides)	,,	11,666	13,995	129,540	145,974
Sodium bicarbonate	,,	176,024	184,143	161,859	166,832
Sodium phosphates	,,	38,958	68,966	173,575	273,468
Sodium silicate	,,	92,834	70,720	82,768	64,886
All other sodium cpds.	,,	339,363	337,419	881,185	913,608
Tin oxide	,,	2,776	1,980	102,230	67,417
Zinc oxide	Tons	1,799	2,198	116,137	158,193
Inorganic chemicals (nes)		—	—	1,262,592	1,027,514
ORGANIC					
Acids, anhydrides and their salts and esters		—	—	313,573	374,395
Glycerine	Cwt.	34,404	9,209	312,039	86,785
Ethyl alcohol, etc., and alcohol mixtures (nes)		—	—	376,438	403,182
Acetone	Cwt.	39,425	39,149	121,919	114,077
Citric acid	,,	17,036	10,597	162,823	112,629
Gases, compressed, liquid or solid (nes)		—	—	484,651	792,521
Phenol	Cwt.	38,142	48,786	251,428	300,570
Salicylates	Lb.	285,025	201,471	86,193	55,604
Sodium compounds	Cwt.	6,918	5,772	94,639	80,198
Sulphonamides, not prepared	Lb.	372,623	543,778	256,151	319,647
Dyestuffs intermediates (nes)	Cwt.	28,699	18,587	363,868	254,663
Organic compounds (nes)		—	—	4,001,200	4,078,172
Total for elements & cpds.		—	—	**16,364,461**	**15,437,639**
Coal tar	Tons	25,019	13,496	251,418	164,282
Cresylic acid	Gall.	833,624	491,009	307,230	184,758
Creosote oil	,,	3,297,582	6,131,321	239,475	445,854
Other mineral tars and crude chemicals		—	—	140,851	61,025
Pigment dyestuffs	Cwt.	6,574	7,138	274,782	308,789
Other synthetic dyestuffs	,,	55,108	40,673	2,494,798	2,082,592
Synthetic organic pigments	,,	6,791	5,032	262,536	205,748
Vegetable and animal dyeing extracts	,,	1,185	786	38,970	45,146
Tanning extracts (solid or liquid)	,,	36,228	33,263	163,935	147,177
Synthetic tanning materials	,,	21,643	21,128	80,640	79,683
Pigments, paints, varnishes, etc.		—	—	6,013,335	6,359,018
Drugs, medicines, etc.		—	—	9,838,949	9,750,723
Explosives		—	—	2,592,996	2,834,181
Insecticides, fungicides and rodenticides	Cwt.	101,437	72,744	1,193,894	975,165
Weedkillers	,,	33,208	18,634	395,915	280,443
Carbons, decolorising or activated	,,	20,803	14,047	92,442	66,095
Tetra-ethyl lead anti-knock compound	Gall.	1,419,167	1,023,582	3,081,901	2,223,884
PLASTICS MATERIALS					
Aminoplastics, solid and liquid resins	Cwt.	—	29,645	—	926,326
Cellulose plastics, moulding and extrusion cpds.	,,	—	16,574	—	250,403
Phenolics and cresylics, solid and liquid resins	,,	—	25,882	—	226,802
Other phenolic and cresylic cpds.	,,	—	26,114	—	494,650
Polystyrene	,,	—	53,853	—	693,550
Polyvinyl chloride, polymers and copolymers	,,	—	38,552	—	345,728
MISCELLANEOUS					
Photographic chemicals (nes)	Cwt.	11,586	10,478	189,512	180,599
Scientific glassware	,,	5,153	5,699	273,701	282,999
Chemical and gas machinery	,,	37,257	49,704	867,913	1,109,181

IMPORTS

		QUANTITY		VALUE	
IMPORTS		Jan.-Mar. 1957	Jan.-Mar. 1958	Jan.-Mar. 1957	Jan.-Mar. 1958
INORGANIC					
Acids	Cwt.	25,510	15,401	75,284	48,484
Aluminium oxide— Crude, unground	Tons	1,957	7,368	96,882	410,870
Ground or graded	,,	899	804	104,146	86,860
Silicon carbide	,,	1,865	1,628	191,328	177,744
Arsenic trioxide	,,	1,186	1,628	38,411	50,924
Borax, refined	,,	145,237	140,500	279,877	301,590
Calcium carbide	,,	206,414	287,548	375,862	549,272
Carbon blacks channel	,,	54,972	52,099	313,590	287,374
Other carbon blacks	,,	21,412	42,144	82,975	177,061
Cobalt oxides	,,	591	3,731	36,941	233,276
Iodine	Lb.	490,942	148,576	189,123	54,509
Mercury	,,	389,909	323,249	432,089	318,265
Sodium, calcium, potassium, lithium, etc.	Cwt.	10,017	13	81,467	3,512
Potassium carbonate	,,	27,051	34,527	86,432	115,175
Other potassium cpds. (not fertilisers)	,,	29,394	21,744	130,947	101,324
Selenium	Lb.	52,115	40,542	278,698	151,020
Silicon	Tons	1,287	2,199	209,081	362,327
Sodium chlorate	Cwt.	30,572	52,834	100,526	182,955
Other sodium cpds.	,,	76,394	127,037	248,716	332,238
Inorganic chemicals (nes)		—	—	745,686	977,337
ORGANIC					
Acids, anhydrides and their salts and esters		—	—	394,225	711,464
Glycerine, crude or distilled	Cwt.	19,238	64,827	118,573	403,147
Menthol	Lb.	69,956	32,514	149,633	63,030
Naphtha, methyl alcohol and alcohols and alcohol mixtures (nes)		—	—	402,528	450,246
Turpentine	Gall.	53,959	51,140	14,728	14,117
Glycol ethers and esters	Lb.	1,679,724	1,367,085	159,190	145,673
Sodium compounds	Cwt.	48,572	27,749	458,843	294,614
Styrene	Gall.	292,548	33,422	160,794	16,151
Vinyl acetate	Tons	1,479	1,146	174,248	134,181
Dyestuffs intermediates	Cwt.	8,433	3,872	288,643	241,021
Organic compounds (nes)		—	—	2,855,318	3,920,245
Synthetic organic dyestuffs and compounds	Cwt.	9,345	7,572	768,687	728,839
Titanium dioxide	,,	26,419	93	267,881	1,034
Other pigments	,,	81,596	75,091	223,406	232,298
Vitamins, their salts and esters		—	—	273,694	356,659
Antibiotics, including penicillin, streptomycin and tyrocidine		—	—	328,602	344,053
Alkaloids		—	—	137,191	156,277
FERTILISERS					
Basic slag	Tons	44,218	46,803	361,431	380,696
Potassium chloride	Cwt.	3,259,064	3,445,657	2,796,098	2,922,604
Potassium sulphate	,,	108,505	106,508	111,846	106,162
Other fertilisers		—	—	803,372	962,964
PLASTICS MATERIALS					
Alkyd solid and liquid resins, solutions, emulsions and dispersions	Cwt.	—	19,663	—	282,242
Cellulose plastics—photographic film base	,,	—	8,218	—	473,963
Other cellulose plastics	,,	—	10,683	—	465,943
Polyvinyl chloride—polymers and copolymers	,,	—	29,316	—	396,061
Other polyvinyl chloride cpds.	,,	—	38,229	—	448,133
Other plastics materials	,,	—	95,916	—	2,129,481
MISCELLANEOUS					
Chemical and gas machinery (nes)	Cwt.	4,632	6,737	203,389	432,449
Explosives	,,	9,512	99	184,430	4,123

EXPORTS OF ALL CHEMICALS TO PRINCIPAL MARKETS

	Jan.-Mar. 1956	Jan.-Mar. 1957	Jan.-Mar. 1958
Ghana	1,143,067	1,273,364	1,113,427
Nigeria	1,456,739	1,255,381	1,610,860
Union of South Africa	3,313,639	3,031,358	3,886,224
India	4,828,596	5,612,331	3,321,994
Singapore	1,018,711	1,182,502	1,087,324
Federation of Malaya	902,865	1,134,234	1,049,180
Hong Kong	768,323	1,125,382	1,101,275
Australia	4,253,722	4,745,995	6,224,267
New Zealand	1,652,268	1,804,782	2,356,519
Canada	1,603,491	1,528,994	1,635,636
Irish Republic	1,760,063	1,491,176	1,700,877
Sweden	1,503,459	1,854,713	1,734,152
Norway	909,662	1,132,909	1,133,279
Denmark	1,120,038	1,321,282	1,293,556
Western Germany	1,452,809	2,029,922	2,234,298
Netherlands	2,222,085	2,543,700	2,378,970
Belgium	1,336,175	1,728,469	1,699,551
France	1,580,919	2,721,756	2,268,515
Italy	2,141,842	2,304,883	2,171,249
United States of America	2,233,045	1,992,087	2,111,299
Total for all countries	**60,139,304**	**67,554,587**	**66,438,256**

People in the NEWS

● Sir Alexander Fleck, ICI chairman, who was to have been chief guest at the dinner held at the Savoy Hotel, London, on Tuesday, to mark the completion of 50 years' service with Albright and Wilson Ltd. by Mr. Kenneth H. Wilson, O.B.E., president, was prevented from attending by a slight indisposition. Sir Alexander, an hon. fellow of the Manchester College of Science and Technology, will later this month formally open the college's new chemical engineering department in Jackson Street. The college council announce that their appeal made last year to industry for funds now totals £177,000.

● Mr. T. A. Rogers, chief engineer and Mr. R. F. Jennings, in charge of the sinter section of Huntington, Heberlein and Co. Ltd., have been appointed technical directors. The company is a subsidiary of Simon-Carves Ltd.

● Among new foreign members elected by the Royal Society are Nikolai Semenov (Moscow), well known for his work on chemical kinetics, especially chain reactions, and Arthur Stoll (Basle), who is distinguished for his work on the chemistry of natural products.

● Mr. J. Loxham, formerly managing director of Sigma Instrument Co., has given up his position to become professor of aircraft economics and production at the College of Aeronautics, Cranfield, Bletchley, Bucks.

● Mr. D. W. Payn, general manager and secretary to the Lead Development Association, has just returned from a two-week visit to the US and Canada. His engagements included attendance at the 30th annual meeting and conference of the Lead Industries Association at St. Louis, and conversations with the Lead Industries Association in New York and with Consolidated Mining and Smelting Co. of Canada Ltd. in Montreal.

● At the annual general meeting of the British Laboratory Ware Association Ltd. the following officers were elected: chairman, Mr. T. A. Dryden (T. Dryden Ltd., Swansea); vice-chairman, Mr. T. H. Hopper (Middleton and Co. Ltd., Middlesbrough); treasurer, Mr. A. Tatman (Townson and Mercer Ltd., Croydon). Elected to three vacancies on the council were: Mr. G. A. Bennie (Mc.Culloch Bros. and Wilson, Glasgow); Mr. J. G. Malpass (W. Finlayson, Stockton-on-Tees); Mr H. B. Toft (A. Gallenkamp and Co. Ltd., London). The secretary is Mr. C. R. B. Spencer, 20 Queen Anne Street, London W1.

● Mr. Robert Lewis Pawson has been appointed an Alkali Inspector for the Sheffield district. After graduating from Kings College, Newcastle-on-Tyne, Mr. Pawson became a plant chemist at a Royal Ordnance Factory in the north in 1942. After the war he joined British Oxygen Co. and worked on their experimental ethylene plant and at the research department at Morden, Surrey. Mr. Pawson then took a year's post graduate course at Battersea Polytechnic and in 1950 joined the Ministry of Supply at Aldermaston and later at Langhurst, in the Armament Research and Development Establishment. Before taking up his present position he was a senior scientific officer.

● Mr. S. E. Clotworthy has been elected president of the Aluminium Development Association for 1958-9. Dr. Maurice Cook (chairman, ICI metals division) was elected vice-president.

● Mr. W. J. Arnot has been appointed technical manager of Melanoid Ltd. He was for some years general manager of H. S. Richards Ltd., paint manufacturers, Smethwick, Staffs., and is at present the treasurer of the Birmingham Paint, Varnish and Lacquer Club. He is also a member of the Midlands branch of the Oil and Colour Chemists Association.

● Dr. G. H. Macmorran is the new secretary of the Scottish department of the Pharmaceutical Society in succession to Dr. David McCall. Dr. Macmorran has been assistant secretary since 1948. Dr. McCall who was secretary for ten years was formerly head of the School of Pharmacy at Dundee Technical College.

● A trade delegation from Ghana recently visited the E-Mil works of H. L. Elliott at Pontypridd, Glamorgan. Heading the delegation was The Hon. P. K. K. Quaidoo, Minister of Trade. Other members were Mr. E. Ayeh Kumi, chairman of the Ghana Industrial Development Corporation; Mr. I. E. Inhumsah, president of the Ghana Railway African Employers' Union, Mr. A. W. Mark Hansen, commercial officer, Ministry of Trade, and Mr. N. J. D. Hammond, assistant trade commissioner, Ghana High Commission, London. They were accompanied by Mr. Hugh C. Byatt, Commonwealth Relations Office, and were shown round the factory by Mr. S. H. Elliott, managing director, and Mr. A. M. Shillam.

● Mr. F. A. Frick, chemist in charge of the Arcolors plant at Newport, of Monsanto Chemicals Ltd., has returned to the Monsanto plant at St. Louis, Missouri recently, taking with him a 27-year-old veteran car. He became so attached to his 1931 model A Ford in America that he brought it with him when he came to England with his family two-and-a-half years ago.

● Mr. Brian H. Turpin, recently appointed managing director of Quickfit and Quartz Ltd., has completed 21 years with the company.

● Mr. Ralph E. Tugman, safety officer for ICI alkali division, is to retire in June. He joined ICI in 1934 and was the division's first safety officer.

● Mr. R. Terrington, of Laporte Industries Ltd., has been appointed chief buyer of raw materials. He will be responsible for the co-ordination of all raw material purchases throughout the Laporte group. Mr. R. S. Harden has been appointed raw materials buyer for the Kingsway works, Luton.

● Mr. D. Milne has been appointed secretary of William Jessop and Sons and of its associated company, J. J. Saville and Co., following the death of Mr. F. Briggs. Mr. J. V. Gregory has been appointed assistant secretary.

● Mr. R. B. F. Wylie, director of the Copper Development Association, represented this country at a meeting held last week in Geneva on copper and its alloys. These international conferences have been instituted to further the exchange of ideas on the general development and usage of copper and its alloys in all branches of industry.

● Mr. Reginald G. Hoare has been appointed to the board of the pharmaceuticals division of Imperial Chemical Industries Ltd.

● Mr. P. H. Hogg and Mr. Eric Stein have been appointed members of the management committee of the Distillers Co. Ltd.

● Sir Hugh Beaver, president Federation of British Industries, was re-elected president of the Institution of Chemical Engineers, at the annual meeting held on Wednesday. Other officers for 1958-59 are: Vice-presidents, Dr. E. H. T. Hoblyn (re-elected), W. K. Hutchison, C. E. Spearing and H. P. Weber (re-elected); joint hon. secretaries (re-elected), F. E. Warner and R. C. Odams; hon. treasurer, F. A. Greene (re-elected); council, A. P. Buchanan, W. J. Chadder, E. W. Greensmith, A. H. Isaac and D. A. B. Llewellyn.

Obituary

Mr. Trefor Davies, technical administration officer to the Association of British Chemical Manufacturers, was found drowned in the Thames at Limehouse on Wednesday 23 April. Mr. Davies, who was 56, had been missing from his home since 9 April. At the inquest on 25 April an open verdict was recorded.

Mr. Davies had been with the ABCM for two years and was secretary to the chemical engineering research and advisory committee and to the instrumentation advisory committee.

The death is reported of Mr. Andrew Mackie Hagart, managing director of African Explosives and Chemical Industries since 1950, in Johannesburg.

Commercial News

Higher Trading Profits Reported by British Chrome and Chemicals

GROUP trading profits of British Chrome and Chemicals (Holdings) were £1,095,509 in 1957 with the inclusion of the full year's profits from Brotherton and Co., acquired in December. The 1956 balance was £598,385. Group net profit is £403,342 compared with £238,285 for the previous year, after tax of £410,703 (£249,100) and depreciation of £281,464 (£111,000). After deducting pre-merger profits and dividends of Brotherton of £156,858, a net balance of £246,484 remains, which includes Brotherton's profits from 16 to 31 December.

The combined trading profits for both years show that in 1957, the total was £1,001,738 as against £953,414. The net profit of £403,342, therefore, compares with £421,313 after tax of £410,703 (£351,422). The incidence of lower investment and initial allowances on capital expenditure during the year is reflected in the increased tax charge.

A sum of £50,000 (£150,000) has been placed to plant replacement and £100,000 (nil) to research and development. The group's balance forward is £159,385 (£148,795), after payment of interim dividends totalling 12½ per cent. There is no final dividend.

A P V Co.

Group net profit for the APV Co. for 1957, subject to audit, was £99,226 compared with £101,328 for 1956. Tax paid was £146,029 (£133,489) and unrequired tax of £23,000 was credited.

No dividend was paid on ordinary (same). Preference dividends were £409,937 (£365,264) and group were £583,914 (£553,154).

Wm. Butler and Co.

Group profits of Wm. Butler and Co. (Bristol) fell from £202,623 to £126,791 in 1957. There is no final dividend but a tax-free capital distribution of 3½ per cent is recommended. The interim dividend was unchanged at 4 per cent less tax and in 1956 was followed by a 6 per cent final.

Howards and Sons

Mr. T. W. Howard, chairman of Howards and Sons Ltd., in his annual statement says that the group results for 1957 (reported in CHEMICAL AGE, last week, p. 782) show some improvement before taxation from the previous year. The increased taxation was due to the high level of business activity during the year which was just sufficient to offset increasing competition and narrowing margins. Prospects for the current year, however, are stated to be uncertain. To date the level of business has been well maintained, but there are signs that some recession is probable, says Mr. Howard.

Turnover of the group increased by 9 per cent over that for 1956. Sales in Great Britain were up by 3 per cent and those to the rest of the world increased by 28 per cent. Sales of technical chemicals increased by 2 per cent, while those of fine chemicals were up by 18 per cent; the contribution of these two products group to total sales was 54 per cent and 46 per cent respectively. Sales outside Great Britain were 29 per cent against 24 per cent in 1956.

A high activity was maintained by the company during the year and many lines were sold up to the limit of manufacturing capacity. It is recorded that there was a welcome revival in several fine chemicals and pharmaceutical lines; this group of products accounting for 51 per cent of the sales as against 47 per cent a year ago.

Turnover of the technical chemicals group suffered, however, from the cessation of two large contracts which had contributed substantially to the sales in the previous year. This reduction has now been largely made good by fresh sales and outlets.

The chairman indicates that there is no doubt that the European Free Trade area will make some of the company's lines uneconomic. Howards' believe, however, that they will be able to continue production of a number of lines competitively if they can effect improvements in their efficiency. The company will, therefore, concentrate on increasing their capacity and improving manufacturing capacity of the most promising lines. In 1957 several new lines reached the commercial production stage and the research department is currently developing several others showing promise.

Matthew Hall and Co.

Capital dividend of 5½ per cent (nil), tax free, is being paid by Matthew Hall and Co., industrial engineers, etc., out of capital profits from the sale of fixed assets, in addition to an unchanged 30 per cent, less tax, dividend for 1957.

Group profit is £99,319, compared with £107,376, after tax of £115,752 (£96,225).

CIC permission has been obtained to a proposed one-for-three free scrip issue. Present issued one-class capital is £180,000.

Evans Medical Supplies Ltd.

Reporting on the progress of Evans Medical Supplies Ltd. in 1957, Mr. I. V. L. Fergusson, the chairman, states that the value of the company's group sales was a record and the current year to date shows further satisfactory progress. He considers the company can look forward with reasonable confidence to satisfactory trading at home, but that the position overseas is more difficult to forecast. Some local economic depressions, shortage of foreign exchange and keenly competitive conditions may render some of the company's overseas markets, which take half of the total production, less remunerative. Other markets, however, are showing satisfactory expansion.

Details of trading profit and dividend for 1957 were reported in CHEMICAL AGE, 19 April, p. 736.

LONDON GAZETTE

Receiving Order

SCHOTZ, SCHACHNO PEISACH, D.Sc., 12 Woodville Road, Ealing W5, carrying on business at 6 and 7 Newcomen Street, Southwark, London SE1, analytical and research chemist. Date of Receiving Order 18 April. Debtor's petition.

Market Reports

CONTRACT DELIVERIES UP TO SCHEDULE

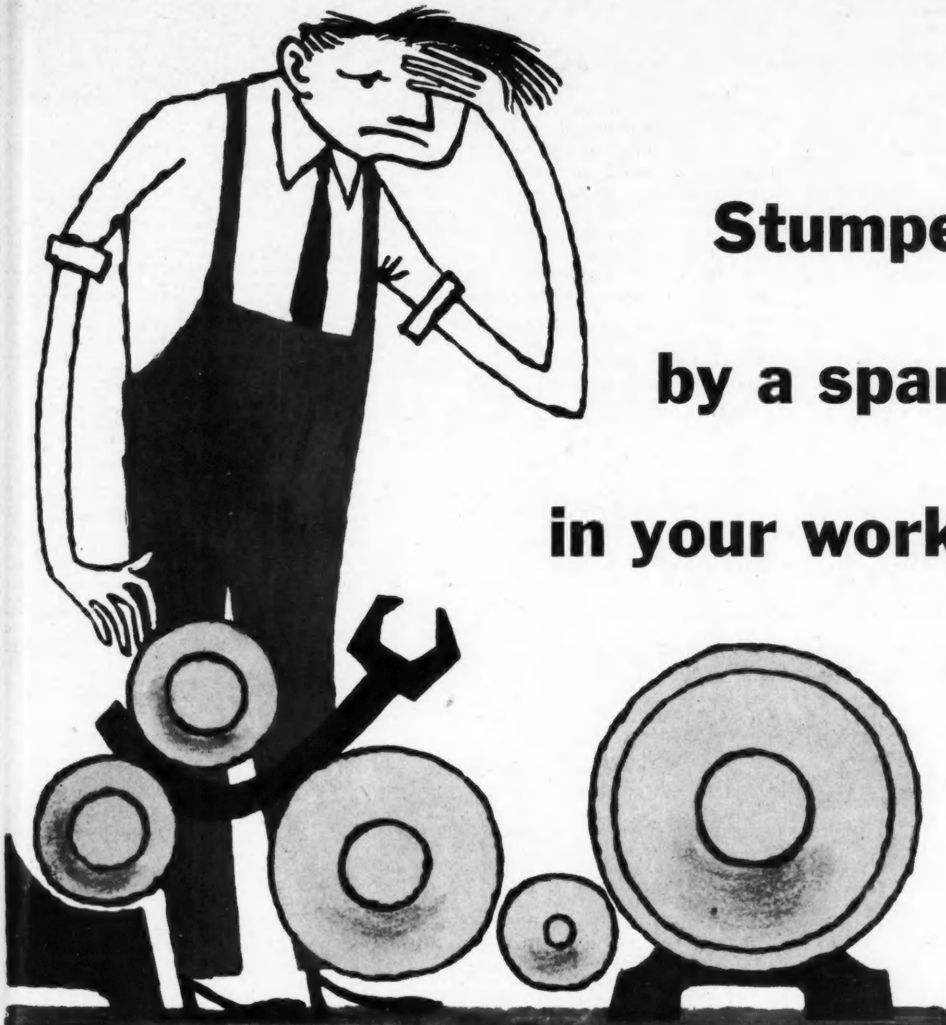
LONDON In the market for industrial chemicals business has again been moderately active and while the flow of enquiries covers most sections of the market. Buying interest on home account is chiefly concerned with current requirements. However, contract deliveries are reported to be satisfactory and well up to schedule. The demand for agricultural chemicals is fairly brisk. Export trade enquiry shows no sign of diminishing and actual bookings have been on a fair scale.

There has been little of fresh interest reported on the coal-tar products market, and prices are unchanged and steady. Crude tar has been in good demand and a steady call has been maintained for creosote oil and the cresylic acids.

MANCHESTER Room for improvement in the demand for bleaching, dyeing and finishing chemicals has been reported by traders on the Manchester market during the past week, but other industrial outlets are drawing steadily against contracts while a fair number of enquiries has been circulating both from home users and from shippers. There has been little change on balance in the general price position, the undertone in most sections being steady. In the market for fertiliser materials, sulphate of ammonia and several other lines are going steadily into consumption. Among the by-products creosote oil, carbolic acid, and the benzols and xylols are reasonably active.

GLASGOW Although a reasonable volume of business was transacted during the past week the general position was rather quieter than the previous week. Some sections did show a slight decline; in particular those of the textile industry. Prices on the whole have remained steady, showing little variation.

In regard to agricultural chemicals, a much more active position can be reported. The overseas market is still showing considerable interest with quite a volume of enquiries being received.



Stumped by a spanner in your works?

The extraction of spanners from works is something that active carbon takes in its stride — particularly if the spanner is an impurity either in your process liquors or in your finished products. It specializes in the removal of unwanted or inhibiting factors in all manner of industrial processes. It cleanses and purifies gases and liquids; removes contaminates such as gums, resins and polymers so that process liquors can be used again; takes out unwelcome smells, tastes and colours from foods, drinks and pharmaceuticals.
Active carbon can also act as a catalyst or a catalyst carrier; assist re-crystallisation; recover useful by-products. In fact there is no end to the money-saving jobs of molecular removal or recovery that active carbon can do for industry.

SUTCLIFFE SPEAKMAN

are the active carbon experts

They are supplying active carbon for the removal of polymers from Cuprammonium Acetate in the Butadiene Plant of British Hydrocarbon Chemicals Limited, Grangemouth.

SUTCLIFFE SPEAKMAN & CO. LTD., Leigh, Lancashire. Tel. Leigh 94. *London Office: 2 Caxton Street, Westminster, S.W.1. Tel. Abbey 3085*

Chemical Stocks & Shares

MARKETS UNDER A CLOUD

MARKETS over the last two weeks have been in a cautious mood after having absorbed the bright features of the Budget. The main influences for an inactive market, such as has been experienced lately, have been the position in Malta coupled with the uncertainty of the US recession and our own industrial wages disputes; these have combined to keep turnover at a minimum.

1957/58 High	1957/58 Low	Security	April 29	Yield %
23/7½	16/4½	Albright & W. 5/-	19/9XD	5
24/6	16/9	Bakelite 10/-	20/3XD	7⅛
36/-	14/10½	Borax Dfd. 5/-	15/9	2⅞
13/10½	10/1½	Bt. Glues 4/-	12/9	5¾
6/4½	4/9	B. I. Plastics 2/-	5/9	7
35/3	27/3	Bt. Xylonite	35/-	7⅛
60/3	45/9	Fisons	52/3	5¾
43/-	24/-	Glaxo 10/-	38/3XD	3¾
34/6	24/1½	Hickson & W. 10/-	32/3	5¼
46/6	36/1½	ICI	43/9XD	5½
4/9	2/6	Kleemann 1/-	3/3	8
17/-	14/-	Laporte 5/-	17/1½	4¾
19/3	12/4½	Monsanto 5/-	16/-	4¼
15/6	11/-	Reichhold 5/-	11/9	8⅛

The undertone, however, is still extremely good. The belief that the Bank Rate will be reduced again before long is now all but universally held and with markets rather inclined at present not to discount future rate reductions the time is surely ripe for the investor to invest in one or two selected first-class chemical equities, while they are at their present prices. ICI, British Xylonite, BI Plastics, Fisons and Hickson and Welch all give good yields, together with growth prospects.

First UK Dido Reactor to be Exported

Head Wrightson Processes Ltd., a subsidiary of Head Wrightson and Co. Ltd., supplied a Dido type 10 mW research reactor for the Australian Atomic Energy Commission's Lucas Heights research station, opened on 18 April (see CHEMICAL AGE, 19 April, p. 731). This was the first export order for a nuclear reactor from a British firm.

TRADE NOTES

On Saturday, 3 May, the Leeds office of Benn Brothers Ltd., proprietors of CHEMICAL AGE, is being moved to Permanent House, The Headrow, Leeds 1. Telephone is unchanged at Leeds 22601.

From 5 May, Hercules Powder Co. Ltd. will operate from a new address, 1 Great Cumberland Place, London W1 (telephone Ambassador 7766). The company have been at their present address, 140 Park Lane, London W1, since 1944.

Monsanto's Silicon Process

Monsanto Chemicals Ltd. have developed a new process for the production of ultra-pure silicon, which is suitable for use in transistors. A further announcement regarding the new process is expected shortly.

Sintered Metals

Ferodo Ltd. have entered the field of sintered metal production on a large scale, providing sintered facings for new clutch and brake designs as well as a range of replacement metallic facings. The company has also started the production of cerametallic friction materials.

P. Leiner and Sons

British address of P. Leiner and Sons (Canada) Ltd. a new Canadian company set up to manufacture, produce, sell, export, import, distribute and deal in gelatine and related products, is care of Treforest Chemical Co. Ltd., Treforest Industrial Estate, Pontypridd. Directors of the company are L. and A. M. Leiner, of the Dingle, Mill Road, Lisvane, Cardiff, F Leiner, 90 Eaton Place, London SW1, R. G. Egan, Millbrook Cottage, Mill Road, Lisvane and J. D. Burnet and L. G. Fraser, Cobourg, Ontario.

New Tapping Fluid

A new tapping fluid has been introduced by Amber Oils Ltd., 11a Albemarle Street, London W1. Known as AP cutting fluid, it is an extreme pressure coolant with unusual penetration properties. It was originally produced for tapping armour plating, but has since been found suitable for tapping all high tensile materials, including Nimonics, etc.

Mullard Semiconductor Division

Mullard Ltd. have established a semiconductor division at Mullard House, Torrington Place, London WC1. The function of the new division will be to coordinate all Mullard product activities in the semi-conductor field. Two departments will be established within the division, commercial and technical.

Monsanto-Cole Agreement

Monsanto Chemicals Ltd. and R. H. Cole and Co. Ltd. have come to an agreement under which Monsanto acquire, as an investment, 50 per cent of the ordinary share capital of R. H. Cole and Co. Ltd., who market raw materials and equipment to the plastics, chemical and electrical industries. It will remain as a separate entity under its own board of directors, with Mr. R. Hugh Cole and Mr. Peter H. Cole continuing as joint managing directors.

Fluoroaromatics

The reference to the work by Mr. Hellman *et al.*, an hexafluoro benzene obtained from the pyrolysis of tinbromo-fluoromethane, noted in the article on 'Fluoroaromatics from polyfluoro*cyclo*hexanes' by Dr. R. Stephens (see p. 834), is *J. Amer. Chem., Soc.*, 1957, **79**, 5654.

DIARY DATES

MONDAY 5 MAY

SCI London section—London: 14 Belgrave Square SW1. 6 p.m. AGM.

TUESDAY 6 MAY

Plastics Institute—London: Wellcome Building, 183 Euston Road NW1. 6.30 p.m. 'Modern ideas on polymer formation and degradation' by N. J. L. Megson.

WEDNESDAY 7 MAY

Incorporated Plant Engineers, Southern branch—Southampton: Polygon Hotel. 7.30 p.m. 'The generation of power from atomic energy' by H. R. M. Hyder.

Institute of Fuel—London: Great George Street SW1. 5.30 p.m. 'Improved sampling equipment for solids in flue gases' by P. G. W., Hawksley, S. Badzioch and J. H. Blackett.

Plastics Institute, Yorkshire section—Cleckheaton, Prospect Hall, 7.15 p.m,

Royal Institution—London: 21 Albemarle Street W1. 9 p.m. 'How light affects the breeding activities of seasonal animals' by Sir Solly Zuckerman.

SAC—London: Burlington House W1. 7 p.m. 'Electrophoresis in chemical biochemistry'.

THURSDAY 8 MAY

CS—London: Burlington House, Piccadilly W1. 7.30 p.m. Heinrich Wieland Memorial Lecture by Prof. Dr. R. Huisgen.

Incorporated Plant Engineers—Glasgow: 425 Sauchiehall Street. 7.15 p.m. 'Oil firing as applied to steam raising plant' by A. W. Rooney.

Royal Society—London: Burlington House, Piccadilly W1. 4.30 p.m. 'Enzymatic oxidation of protein as a rate determining step in formation of highly stable surface membranes' by B. M. Jones; and 'Amino-acid metabolism of developing insect cuticle: larval cuticle and puparium of the blowfly' by R. Dennell.

SCI, Microbiology group—Folkestone: Visit to Pfizer Ltd. (Train from Charing Cross, 9.08 a.m.)

Wholesale Price Index Numbers for March

WHOLESALE price index numbers for chemicals for March have just been published. The values compared with February this year and March 1957 are shown in the following tables:

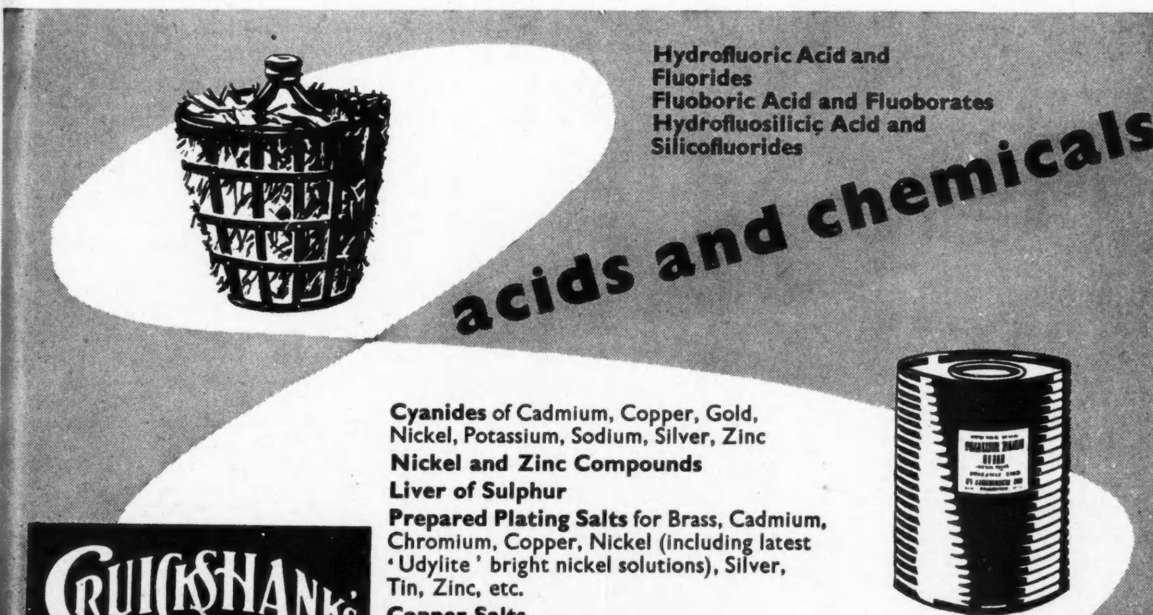
	Mar. 1957	Feb. 1958	Mar. 1958
Dyes and dyestuffs	111.0	111.1	111.1
Disinfectants	112.1	112.9	112.9
Fertilisers	119.1	120.3	120.4
Insecticides, weedkillers and fungicides	101.3	95.0	93.0
Synthetic resins and plastics materials	94.8	94.7	94.7*
General chemicals	106.6	108.1*	108.0*
Benzole, pure, BSS136–1950	121.3	106.9	106.9
Caustic soda liquor, 100°Tw	108.7	116.3	116.3
Soda ash, light (delivered)	108.8	115.3	115.3
Soda ash, light, f.o.r. works	109.9	117.7	117.7
Sulphuric acid, BOV ...	114.4	103.9	103.9
Sulphuric acid, ROV 94/95 per cent	106.0	104.7	104.7
Drugs and pharmaceutical preparations	96.6	98.9*	98.4

*Provisional figure

Crosfield Acquire Trade Name from Peter Spence

THE trade name Neosyl has been acquired by Joseph Crosfield and Sons Ltd., Warrington, from Peter Spence and Sons Ltd. Crosfield are now manufacturing and marketing a comparable product under that name.

Neosyl is a fine white powder of exceptionally small ultimate particle size, (about 0.10 micron), and is a pure form of amorphous silica. Among its applications are: as a matting agent in paints and lacquers, a mild abrasive in polishes, a carrier and dispersing agent for insecticides, a pesticide in the control of certain pests, an ingredient in toilet and cosmetic preparations, an intermediate for certain pharmaceutical silicates, and for thermal insulation materials.


Hydrofluoric Acid and Fluorides
Fluoboric Acid and Fluoborates
Hydrofluosilicic Acid and Silicofluorides
acids and chemicals
Cyanides of Cadmium, Copper, Gold, Nickel, Potassium, Sodium, Silver, Zinc
Nickel and Zinc Compounds
Liver of Sulphur
Prepared Plating Salts for Brass, Cadmium, Chromium, Copper, Nickel (including latest 'Udylite' bright nickel solutions), Silver, Tin, Zinc, etc.
Copper Salts
Carbonate, Chloride, Nitrate, etc.
CRUICKSHANKS
R. CRUICKSHANK LIMITED
CAMDEN STREET, BIRMINGHAM, 1
Telephone : CENtral 8553 (6 lines) Telegrams : Cruickshank, Birmingham.

NEW PATENTS

By permission of the Controller, HM Stationery Office, the following extracts are reproduced from the 'Official Journal (Patents)', which is available from the Patent Office (Sale Branch), 25 Southampton Buildings, Chancery Lane, London WC2, price 3s. 3d. including postage; annual subscription £8 2s.

Specifications filed in connection with the acceptances in the following list will be open to public inspection on the dates shown. Opposition to the grant of a patent on any of the applications listed may be lodged by filing patents form 12 at any time within the prescribed period.

ACCEPTANCES

Open to public inspection 28 *May*

Preparation of lubricating grease compositions. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **794 711**

Processes for the production of pure germanium. Kirby, H. D. B. (Siemens & Halske AG.) [Divided out of 794 641.] **794 643**

Dyeing of polyester textiles. Soc. Rhodiaceta. **795 768**

Silver peroxide electrodes for primary batteries, and methods for making same. United States of America, Secretary of the Army of. **795 834**

Finishing leather with resin dispersions. Imperial Chemical Industries, Ltd. **795 711**

β-kainic acid, its isomers and their derivatives and a method for preparing their inverted compounds. Takeda Pharmaceutical Industries, Ltd. **795 750**

Preparation of higher aliphatic alcohols. Soc. Belge de L'Azote et Produits Chimiques du Marly. **795 573**

Anti-stalling gasoline agent. Esso Research & Engineering Co. **795 751**

Recovery of gold. Soc. d'Electro-Chimie, d'Electrometallurgie et des Acieries Electriques d'Ugine. **795 790**

Treatment of arsenical ores. Soc. d'Electro-Chimie, d'Electrometallurgie et des Acieries Electriques d'Ugine. **795 791**

Treatment of arsenical and sulpho-arsenical ores. Soc. d'Electro-Chimie, d'Electro-Metallurgie et des Acieries Electriques d'Ugine. **795 792 795 793**

Alkylation of aromatic compounds. Universal Oil Products Co. **795 574**

Polymerisation of unsaturated organic compounds. Universal Oil Products Co. **795 713**

Manufacture of omega aminocarboxylic polymers. Goodyear Tire & Rubber Co. **795 755**

Process for the production of shaped articles of cellulose acetate by extrusion into an aqueous coagulating bath. Soc. Rhodiaceta. **795 716**

Catalyst and process for its preparation. Esso Research & Engineering Co. **795 719**

Streptomycin salts and process for their preparation. Koninklijke Nederlandsche Gist- En Spiritusfabriek N.V. **795 757**

Amino esters and the preparation thereof. Pfizer & Co., Inc., C. **795 758**

Organic substituted carbodiimide-isocyanate addition products. Farbenfabriken Bayer AG. **795 720**

Preparation of hydrocarbon oils free or virtually free from mercaptans. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. **795 762**

Treatment of platinum-containing catalyst. Houdry Process Corp. **795 629**

Treating iron or mild steel to permit the adherence of porcelain enamel, and the products obtained thereby. Armco International Corp. [Addition to 674 490.] **795 632**

Hydroforming. Esso Research & Engineering Co. **795 839**

Recovering nickel from salt solutions. Siemens & Halske Ges. **795 595**

Manufacture of acetyl-acetone. Wacker-Chemie Ges. **795 843**

Production of nitrogen oxides. Olin Mathieson Chemical Corp. **795 845**

Sulphonation process. Esso Research & Engineering Co. **795 763**

Method and apparatus for double decomposition. Nederlandse Organisatie Voor Toegepast-Natuurwetenschappelijk Onderzoek Ten Behoeve Van Nijverheid, Handel En Verkeer. **795 636**

Metallising of ceramics. Compagnie Francaise Thomson-Houston. **795 846**

Recovering amines from the residues in the production of aromatic isocyanates. Farbenfabriken Bayer AG. **795 639**

Dyeing polyester materials. Farbenfabriken Bayer AG. **795 701**

Production of oil solutions of petroleum sulphonic acids. Shell Research, Ltd. **795 642**

Acetylenes removal from diolefin streams. Esso Research & Engineering Co. **795 855**

Sulphonyl urea derivatives. Boehringer & Soehne Ges., C. F. **795 606**

Salts of novobiocin. Soc. des Usines Chimiques Rhone-Poulenc. **795 856**

Method of controlling the viscosity of petroleum oil compositions. Armstrong Cork Co. **795 858**

Manufacture of resins. Union Chimique Belge Soc. Anon. **795 609**

Distilling vinyltoluene. Dow Chemical Co. **795 650**

Measuring dispenser for liquids. Lesnick, M. L. [Divided out of 795 796.] **795 797**

ACCEPTANCES

Open to public inspection 4 *June*

Production of heavy water. Murphree, E. V. **795 920**

Gas sampling apparatus. Kent, Ltd., G. **796 010**

Polyalkalylene ether-polyurethane polymer and elastomeric products obtainable therefrom. Du Pont de Nemours & Co., E. I. [Addition to 731 071.] **796 041**

Infra-red gas analysers. Parsons & Co., Ltd., C. A. **796 090**

Pre-treatment of polymers and modified polymers obtained thereby. Polymer Industrie Chimiche. **796 148**

Method of and apparatus for treating fluid substances by electro dialysis. Kollsman, P. **796 149**

Polyalkylindane derivatives. Polak's Frutal Works, Inc. **796 129**

Curable polyurethaneurea elastomers. Du Pont de Nemours & Co., E. I. **796 042**

Piperazine derivatives. Soc. des Usines Chimiques Rhone-Poulenc. **795 926**

Preparation of peracids. Union Carbide Corp. **795 927**

Process and installation for separating and obtaining tar, ammonia and ammoniacal liquor for gaseous products of dry distillation. Still, K. F. [trading as Still, C. [Firm of]]. **796 095**

Paints compounded from internally plasticised resins. National Starch Products, Inc. **795 928**

Purification of ethers of alkylene glycols by distillation. Esso Research & Engineering Co. **795 866**

Producing carbon disulphide. Food Machinery & Chemical Corp. **796 153**

Graphite suspension and method of making same. Jacobson, A. **795 957**

Fertilisers. Fisons, Ltd. **795 959**

Unsaturated bicyclic compounds and their polymers. Imperial Chemical Industries, Ltd. **796 133**

Fuel compositions. Rutter, L. F. **796 154**

Recovery of dry substances from their solutions or suspensions by evaporation in thin layers. Farbenfabriken Bayer AG. **795 871**

Liquid-liquid countercurrent extraction of a liquid mixture. Texaco Development Corp. **795 872**

Oil-soluble polymer composition. Esso Research & Engineering Co. **795 863**

Synthetic polymers. Imperial Chemical Industries, Ltd. [Cognate applications 35390 and 3917.] **796 134**

Detergent compositions. Unilever, Ltd. (Lever Bros. Co.) [Addition to 766 401.] **795 878**

Preparation of cyanuric acid from urea. Montecatini Soc. Generale per L'Industria e Chimica. **795 879**

Antifouling paint. Osaka Kinzoku Kogyo Co., Ltd. **795 880**

Polymerisation process. Distillers Co., Ltd. [Cognate application 3145.] **795 882**

Manufacture of highly polymeric polymethylene terephthalates. Imperial Chemical Industries, Ltd. [Cognate applications 21122, 21248 and 4200.] **795 968**

Metallising textiles. Heberlein & Co., AG. **796 138**

Manufacture of metal strip. Mond Nickel Co., Ltd. **796 220**

Preparation of peracetic acid. Food Machinery & Chemical Corp. **795 889**

Increasing the cetane number of compression ignition engine fuel. Ethyl Corp. **795 929**

Stabilisation of chlorinated hydrocarbons. Diamond Alkali Co. **795 891**

Polymerisation process. Imperial Chemical Industries, Ltd. **795 971**

End box for a mercury cathode electrolytic cell. Dow Chemical Co. **796 142**

Mercury-cathode electrolytic brine cell. Dow Chemical Co. **796 143**

Silica cements. Simon-Carves, Ltd. **796 172**

Catalysts and the production thereof. California Research Corp. **796 175**

Dithiophosphate esters and salts thereof and lubricating compositions containing them. Esso Research & Engineering Co. **796 181**

Production of moisture-proof films. British Cellophane, Ltd. [Addition to 677 926.] **796 067**

Moisture proofing of luminescent thallium-activated sodium iodide. Cole, Ltd., E. K., and Toogood, M. J. **796 187**

Analytical Review

(*Continued from page* 836)

innocuous by addition of sodium sulphide; no further separation was required. Solochrome Black T screened with methyl red was used as indicator. The method appears to be rapid and precise. The reviewer is surprised at the stability claimed for the indicator formulation and doubts if the reason advanced for the stability (*viz*. preventing evaporation) is correct. The experience of most other workers is that oxidation is the chief cause of decomposition.

REFERENCES

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(2) C. Bertin, *Anal. Chim. Acta*, 1952, 7, 105.
(3) M. Kilpatric, and R. D. Eanes, *J. Amer. Chem. Soc.*, 1942, 64, 2065.
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(6) D. A. Skoog, M. G. Lai, and A. Furst, *Anal. Chem.*, 1958, 30, 365.
(7) M. J. Miles, W. J. Mesimer and M. Atkin, *ibid.*, 1958, 30, 351.

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